Testimony
of
Captain Duane Woerth, President
Air Line Pilots Association, International
to the
Commission on the Future of the United States Aerospace Industry
August 22, 2002

Since the attacks of 9/11, security has obviously moved to the forefront, and justifiably so because our nation must protect itself against acts of terrorism. As the Nation confronted the difficult issues resulting from these atrocities, the public has recognized the crucial importance of the aviation industry to our national economy. It has become clearer than ever before that the health of the aviation industry must be carefully protected. As we recover and continue to improve our security, we must also improve the efficiency and capacity of the ATC system. As demand on the system returns, we must remain aware that, in addition to the increased emphasis on security, the issues facing the users and ATC providers of the National Airspace System (NAS) are the same today as they were on September 10th. These issues include topics you asked me to discuss today: system capacity, workforce challenges, obstacles to innovation, and needed long-term developments. I want to stress that while the security issues that we have always been working on have moved to the front burner and as we pursue the issues discussed today, ALPA remains strongly committed to improving safety and system efficiency, as exemplified in our motto, Schedule with Safety.

RESTRUCTURING OF THE AIR TRAFFIC CONTROL SYSTEM

The Air Traffic Control System of the United States should be regarded as a national treasure. Its value has been estimated at three trillion dollars, and it belongs to the millions of people who have paid for it, with taxes and with user fees. We shouldn't make changes to this system without a great deal of thought and consideration for those users.

All of us who are part of the aviation industry are aware of the serious problems that the FAA encounters in performing its duties, and we want those problems to be fixed. This is not news. In 1988, ALPA was part of a coalition of 12 aviation groups that examined the FAA and its problems. In 1993, the National Airline Commission addressed the FAA and the problems that face it today. Both groups recommended an independent FAA. In 1997, the National Civil Aviation Review Commission (NCARC) recommended establishment of a Performance Based Organization (PBO) to manage air traffic systems, programs, and procedures. That recommendation has been acted on, but there is not yet a leader for the effort. Until that effort can be allowed to advance, problems with the FAA will remain precisely the same problems the earlier studies identified: funding, procurement procedures, and personnel.

Let me begin with funding. The federal budget process cannot be depended on for a stable, predictable source of revenue. Nor can it be relied upon to provide the capital improvement funds so necessary for a state-of-the art air traffic control system. We concur with the recommendations made by the NCARC in 1997 supporting robust, reliable funding for efforts to modernize the National Airspace System.

The second area that needs immediate attention is procurement. The miles of red tape involved in the existing procurement procedures practically ensure that the high tech equipment required by the FAA, and ATC in particular, are no longer state of the art by the time the cumbersome procurement procedures are followed. If the ATC system is to be a separate entity, one of the first and most important posts to be appointed must be a high level executive with the authority to procure equipment quickly.

The third and final area is personnel. Perhaps this is the most important of the three. We need only the most capable men and women in charge of our nation's air traffic control system. Only the best and brightest should be hired and their training should be top notch. If a separate ATC system is created, separate salary levels can be put into place. Salaries should be good enough to attract the best candidates and reach levels that will retain the best employees.

Restructuring the system and modernizing the components of it cannot be done without careful planning and a coordinated approach to resource allocation. Thus, it is imperative that government and industry collaborate to create a vision of the industry's future. This vision must be well thought out and must be the single roadmap for advancements in safety and efficiency. Without a plan to guide the overall efforts of the industry, we may see gains and improvements in isolated segments of our industry, but they may not complement one another and they will surely not make the best use of limited resources.

System Capacity and National Airspace Modernization

ALPA has been a leader in building aviation industry consensus on programs that will improve efficiency and increase system capacity, while ensuring that these programs maintain the highest level of safety. In September 1999, the ALPA Executive Council endorsed an ALPA National Airspace System Modernization Strategic Plan as a vital step toward assisting in the restructure of the NAS and the pilot's working environment. The goals of ALPA's NAS Modernization initiative are: To advocate appropriate levels of funding for NAS Modernization programs; encourage basic research, development and implementation for new and improved Air Traffic Management tools; continue to assist in developing a joint U.S. industry/government document that is truly responsive to user needs on future NAS requirements that would be in addition to the NAS Architecture; work to insure that the National Civil Aviation Review Commission's report on funding and aviation is considered in the modernization plan; work to strengthen and maintain industry consensus that will be critical to the success of NAS Modernization; and ensure effective pilot input into the modernization effort.

The ALPA NAS Modernization Initiative ranks safety as the highest priority and, as I stated to RTCA in October 2000, can be summed up as follows:

"Modernization is all about change, implementing new ideas and concepts, using new technology, equipment and procedure, to better serve the public's needs, and doing so in a safe, timely and economical manner."

To fulfill that mandate, ALPA safety representatives are active in a variety of industry groups. These groups are addressing such diverse initiatives as closely spaced parallel runway operations, land and hold short operations, regional airspace redesign, airport planning, reduced vertical separation procedures, and many more.

ALPA has been a strong proponent of development of operational concept and requirement plans for the NAS, and for defining the NAS Architecture based on these requirements. It has taken several years, but FAA and industry have now adopted this approach. The FAA has chartered a Federal Advisory Committee within RTCA to facilitate the planning of NAS improvements based on this methodology. Currently, one of our main concerns is implementing the technologies and responding to the operational requirements as we progress through Free Flight Phase 1 and 2 and advance toward Phase 3 and beyond.

The Operational Evolution Plan

ALPA strongly supports the FAA's ten year Operational Evolution Plan (OEP). The OEP is a living document that prescribes where modernization work is headed and serves as a means to evaluate how it is progressing. In particular, the implementation details and schedules are continually scrutinized to ensure they are realistic and deliverable. The FAA's management of this comprehensive plan, supported by industry consensus and constructive input, will be critical to the success of NAS modernization. The OEP focuses on gate-to-gate system efficiency improvements – a true system approach. OEP initiatives take advantage of the latest developments in communication, navigation, surveillance, and information technologies to identify ways to increase the air traffic throughput, improve traffic management, and increase the safety and efficiency of flight.

Funding for all of the individual projects within the OEP is critical, as is prioritization of the projects. It is an ambitious plan that must continue to receive the top monetary and personnel resources if NAS modernization is to succeed. It is the key to timely and safe emerging technology integration. Failure to adequately fund these initiatives will not result in partial gains, it will only result in wasted resources.

One of the critical projects within the OEP is the development of criteria and policy that can be used to employ navigation systems based on the Required Navigation Performance (RNP) concept. RNP promises to significantly improve the accuracy, integrity, availability, reliability and continuity of terminal and enroute navigation in the NAS. RNP promises not only efficiency gains, but also real, demonstrable safety improvements at the same time. The concept has the potential to make a large contribution to reducing accidents caused by controlled flight into terrain (CFIT) and during approach and landing. RNP also takes advantage of aircraft performance capabilities to improve airspace efficiency in route selection, navigating and potentially reducing enroute separation standards. For these reasons, ALPA is an advocate for the rapid development and implementation of RNP procedures.

Availability of Timely Weather Data

It is simply unacceptable that a passenger in the cabin with a laptop computer and a telephone connection has the capability to receive better weather graphics than our pilots have in the cockpit. Minutes old NEXRAD (Next Generation Radar) weather displays may be accessed on the Internet, but the same capability for a cockpit display is slow in coming. NEXRAD weather data is a quantum leap in resolution and capability to display weather phenomena. The OEP includes projects to improve the availability of weather information in cockpits. It is essential that these projects stay on schedule. Weather is a leading factor in aircraft accidents.

Federal regulations specifically state minimum weather information requirements for airline operations, and all of the companies whose pilots we represent meet those requirements. However, telecommunications research has demonstrated dramatic capabilities for providing digital weather information to our cockpits that could provide strategic awareness of storm systems like the one at Little Rock that was a factor in the American Airlines accident last year. In other words, better information available prior to descent can give flight crews the information to make good decisions early rather than forcing them to react to unknowns.

That information is currently in demonstration on a Boeing 757 of a major carrier. It is tailored for a multi-function electronic cockpit display combining weather, traffic, track, and other data appropriate for the sequence of flight. ALPA has testified at Congressional transportation committee hearings that the research is sufficiently mature that the time is right to certify an electronic data link capability for air carrier operations. We have also recommended that similar displays be available to air traffic and dispatch, so that weather decisions may be made collaboratively from the same data. Better weather information improves the decision process for weather avoidance and timely rerouting. Safety and efficiency are the benefits.

Understanding Delays

The issue of Air Traffic Service delays, and their relationship to system safety, is an issue in which ALPA has a deep and lengthy history of interest. The air traffic control system has become a convenient target and a scapegoat for much deeper systemic problems. Air traffic control is often blamed for delays it is compelled to implement to maintain the safety of the National Airspace System. However, many of these delays are actually caused by problems outside the control of air traffic.

Delays are symptoms or manifestations of larger problems or uncontrollable situations in the National Airspace system. Delays can come from a number of sources; the two most prominent are airspace and airports – although it is in the interface of these two elements that seems to produce most delays. The causes of delays include weather, scheduling based on optimum weather scenarios, the hub & spoke system, usable runways, and gate availability, among others. Against that background, there are locations throughout the system that sometimes are at absolute maximum capacity even without the influence of other factors such as weather. When these other external elements are added, the current system struggles, not always successfully, to react.

It is clear that at certain times on certain days, scheduled traffic at the hubs is once again approaching absolute capacity. Most of the time, Visual Meteorological Conditions (VMC) prevail and airline schedules are based on VMC airport arrival rates. When the weather drops below visual minimums, especially at airports with limited instrument landing capability, the impact begins to ripple through the system. When an airport must restrict use of its runways because spacing or configuration precludes their use under Instrument Meteorological Conditions (IMC), then the airport acceptance rate falls. This decrease in acceptance rates then means departure rates are cut. This results in ground delays at departure airports, inbound airborne aircraft holding, and then ground delays for departures at the arrival airport where planes are waiting to take off – a domino effect throughout the system. It is a well known phenomenon in the industry that significant delays at just one of the large hub airports can be felt by flights all over the country and beyond. In the summer thunderstorm season, when severe convective weather activity develops, airports are often closed to all traffic for an extended time, creating havoc in the system. The government-industry oversight group, known as S2K+2 (Summer 2000 plus 2years), started in early 2002, exercises strategic and tactical management of the NAS and has shown that closer management can relieve some of the problems. But there is no total solution to mitigating the impact of severe weather, except to not fly into or near it. Maintaining the safety of the system is the guiding principle for all decisions.

The flying public has been given unrealistic expectations by promises that they can fly where they want to, when they want to. To satisfy this demand we have a scheduling system that allows more aircraft into the same environment at the same time than the system can efficiently handle, even on the best of days. The schedule unrealistically projects everyone into an airport in a one hour time period; everyone tries to get there as early as possible, so the real crunch occurs in a thirty-minute block. Therefore, whenever uncontrollable events like weather occur the system has no flexibility.

Our pilots are every bit as concerned about these delays as are you and the flying public. Delays, particularly when they occur unexpectedly in flight, reduce fuel reserves and increase complexity of flight crew decision-making. Delays on the ground can extend already long duty periods and put crews in the position of trying to balance safety against schedule. These experiences, combined with some of the less than well thought out capacity initiatives the FAA has tried in the past, have only served to reinforce our suspicions that capacity is sometimes being emphasized to the detriment of safety. We still have the safest system in the world, but our confidence in it is challenged by what we experience on a daily basis.

Capacity Enhancements

Several of the FAA's innovative capacity enhancements have been aimed directly at one aspect of the equation – how can we get more airplanes on the concrete at the same time? Air traffic control has very specific, safety-based restrictions on runway utilization. These separation standards are designed to ensure the safety of an aircraft and its passengers so we cannot afford to lessen these standards without complete evaluation involving representatives from all stakeholder groups. Capacity critical initiatives must be backed with data that proves that the minimum level of safety is maintained or enhanced. The FAA clearly has the burden of proof.

ALPA believes that construction of new runways, taxiways, terminals and other infrastructure is equally important, if not more so, than the development of additional ATC capacity initiatives. And, in fact, many of the top 100 airports are planning new and extended runways and other facilities to create more capacity. The ultimate restriction or bottleneck to capacity is runway availability for takeoffs and landings. Runway construction must continue to realize the full measure of the efficiency enhancements implemented in enroute and terminal airspace.

Resectorizartion of enroute airspace can lead to some efficiency gains. Initial evaluation of en route airspace resectorization proposals being touted by a number of potential contractors seems feasible – and they may well be, but not quickly. As with potential fixes to other problems, the technology is available to accomplish resectorization now. In fact, RTCA has Special Committee 192 looking into this concept, among others, to better utilize our national airspace. The recommendations that will be forthcoming from this Committee will result in better management of our scarce airspace resource but will not be possible without allowing the FAA to consolidate facilities and that will require some tough political decisions.

ALPA's motto is Schedule With Safety. We will continue to champion that standard and will work with the FAA and members of the aviation industry to develop initiatives that will improve efficiency, as well as maintain and hopefully improve the safety of air operations. All capacity initiatives must be proven to maintain or increase the safety of air operations and good test and evaluation data is needed to support the implementation of new technologies and procedures. We can accept nothing less.

Environmental Concerns

Environmental concerns have a great impact on the aviation industry. Noise restrictions constrain arrival and departure routes thereby exacerbating the delay problem. The airlines and manufacturers have spent millions of dollars designing newer, quieter aircraft. Pilots are compelled to fly highly complex procedures at or near minimum safe operational performance standards to comply with ground based constituent concerns. The industry has done all it can do to alleviate these complaints. There must be a paradigm shift in the public to understand that part of the cost of reducing system delays may be the more efficient use of terminal airspace and aircraft performance capabilities – and that may result in an aircraft overflying someone's house. This wholesale acquiescence to noise concerns without thorough analysis of safety impacts may have to change if we are to thoroughly address the entire scope of the delay problem.

Human-Centered Design, Automation and Training

Our success in modernizing our NAS will depend, in part, on effective application of human factors concepts, principles and objectives in conjunction with program development. Human factors is a multidisciplinary field, which examines not only human-machine interfaces, but the relationships between human operators and their behavior within working environments. In order to optimize human performance and reduce human errors, we must clearly understand their capabilities and limitations in our design, build and implementation activities.

Designers must fully understand that if the human operator is responsible for the outcome of actions involved in an operation, then the primary focus must be on the human in design considerations. Design requirements must clearly state what is expected of the human in an operation and the extent to which it is compatible with human capabilities and limitations. Under these circumstances, humans must be actively in the loop and their roles, authority and responsibility must be clearly delineated.

Automation has been and continues to be a challenge for designers. It is imperative, therefore, that automated system interfaces be designed to not only prevent human error, but to prevent jeopardizing the safety of an operation when errors are committed (error-resistance vs. error-tolerance). The potential loss of situational awareness must be considered. Its use must also take into account the potential degradation of operator skills. Accordingly, we must ensure there is a balance between automation being transparent verses subordinate to the human. Automation features should be predictable, adaptable to a range of human operator preferences and variables yet reasonably simple and reliable [Billings].

US National Strategic Plan for Safety

Proactive Safety Programs and Management Philosophy

With regard to safety, we have a two-fold challenge. On the one hand we must ensure that we build safety into our systems, right up front. That is, the design and fielding of major NAS modernization acquisitions requires a system safety approach from the very beginning of the program until it is retired, if we hope to realize uninterrupted and long term benefits. Implementation of this approach in recent years into the FAA's new Acquisition Management System (AMS) process will undoubtedly help. However, the development of satisfactory requirements, safety analysis, investment analyses and specifications remain challenges for us throughout these process steps. The ever-increasing interdependence of ground and airborne systems and equipment presents us with unique challenges as well. We believe that the system engineering aspects associated with this work is very important and needs to be robust. Coordinated, properly phased development of complementary air- and ground-based components of new systems is critical to efficient use of national resources. Our ability to identify potential hazards and assess associated risks is hampered without a more robust effort in this field.

On the other side of the coin, is our ability to successfully operate using these systems. From the standpoint of air carrier operations, we must look at how we address safety at the national level as well as at the operator level. Both the White House Commission on Safety and Security and the National Civil Aviation Review Commission (NCARC) recognized the importance of safety risk management as one of the key elements in a strategy to significantly reduce the accident rate in commercial air transport operations. The NCARC report stated:

Today, technology, safety reporting, and risk management concepts are emerging that could literally identify most aviation safety problems before they become accidents... an effective means to quickly reduce the accident rate is to implement a safety risk management program in each company across the aviation community. The risk management program should include a combination of a company self-audit and an ASAP-like self-disclosure program. Such programs *should include the analysis and sharing of reports from aviation professionals among industry members and between the industry and the FAA. A similar but more aggregated program should be administered at the national level to ensure that the government is focusing its aviation safety resources according to the results of such programs.*

Systematic Approach to Risk Management

The NCARC, chaired in 1997 by our current Secretary of Transportation, Norm Mineta, recommended that a government/industry coalition of aviation safety stakeholders be formed to set a single agenda for advancing aviation safety. The Commercial Aviation Safety Team (CAST) was formed following this NCARC recommendation. CAST was chartered to follow a data-driven, consensus based process to design a National Strategic Plan for Aviation Safety. Four years of research and collaboration have now produced the foundation for that National Strategic Aviation Safety Plan.

In its July 2002 meeting, CAST completed its approval for implementation for forty-six Safety Enhancements. These forty-six Safety Enhancements, when implemented, will result in approximately a 65% combined reduction in risk of fatalities across the accident categories. These forty-six Safety Enhancements were chosen as a first priority because of their relatively high-risk mitigation when balanced with the resources required to implement them. These Safety Enhancements are based on a detailed study of more than 80 U.S. accidents since 1987.

It is critical that the government/industry collaborative process that CAST has come to represent continue. This data-driven, consensus-based process has laid the foundation for an order of magnitude reduction in risk in commercial aviation, not only in the United States, but also in the worldwide commercial sector. The positive benefits that have resulted from CAST have been recognized worldwide by the implementation of CAST- like processes in the aviation community in Europe, Asia, and Central and South America.

An important issue related to CAST's process of identifying the consensus safety agenda for government and industry partners in the future is how we transition from a reactive system based on accident investigation data to a pro-active system using incident and event data to identify the most relevant risks to mitigate next. Accidents are increasingly more rare but increasingly more complex. The sophistication of our processes to "mine" or analyze incident data must be continuously improved. As industry and government collectively move toward a National Strategic Plan for Aviation Safety, we will be required to increasingly move from a reactive to a preventative model of mishap prevention.

Achieving the next order of magnitude reduction of risk in aviation will require focusing on incident data (as opposed to only accident data) to identify the precursors of catastrophe. The move from studying primarily accident data to a reliance on incident data will require improved data collection systems, procedures, and protections among all the stakeholders within the aviation community. Pro-active, non-punitive incident data collection programs like Flight Operations Quality Assurance (FOQA) and Aviation Safety Action Partnership (ASAP) will be key to determining the most relevant future risks to target in our evolving National Strategic Plan for Aviation Safety.

Safety Management Systems

At the level of the individual major air carrier, operators all have safety programs and since 1996, have had Directors of Safety. However, it should be noted that this position was a relatively recent FAA regulatory action and one largely undertaken due to ALPA's urging. While the major airlines have over the years learned hard lessons from previous accidents and established safety programs on their own initiative, we have yet to establish a regulatory standard requiring them and the critical attributes. Our membership experiences a variety of safety management policies and programs. These vary across air carriers. It is our view that without a standard, airline safety programs will continue to evolve at varying paces, and with varying success.

The International Civil Aviation Organization (ICAO) requires (Annex 6, Part 1) that operators have an accident prevention and flight safety program. In recent years other regulatory authorities have taken action to comply with this standard. For example, the Joint Airworthiness Authorities came to an agreement and implemented this standard in JAR OPS 1 (1.037), which can be integrated into the Quality System standard required of air carriers. The Australian Civil Aviation Authority has taken similar steps. And more recently, Transport Canada has drafted rulemaking to require air carriers to implement a safety management system program.

If we expect to meet the future challenge of significantly reducing the accident rate, to fully act on the recommendations of the White House Commission and the NCARC, and to comply with international standards, then we need to take this important step in the US as well. However, much work must be done to successfully implement a safety management system within our air carriers. We do not have a consensus today on all the right attributes of such a program. There are varying views about what comprises safety risk management.

For example, we have only been partially successful in moving forward non-punitive reporting programs, such as, the Aviation Safety Action Partnership (ASAP) and Flight Operations Quality Assurance (FOQA). We have struggled to get this far simply because the FAA has had difficulty acknowledging a fact identified by the White House Commission…

"…given the tremendous growth and globalization in the industry, it is neither realistic nor desirable to expect the FAA to rely on hands-on inspections to ensure safety. It is critical that industry be given the incentives and flexibility to be full partners in this effort and be encouraged to monitor and improve their own performance. This will not only produce better focus on results, but will also allow the FAA to deploy its resources more effectively."

Specifically, it has been difficult for the FAA to find the balance between their regulatory enforcement responsibilities and the means to allow air carriers to improve their own safety performance. We have spent a great deal of time and energy on some of the tools, like non-punitive reporting programs. What we need to spend more time on is the "tool box," the framework needed to permit the development and execution of these important tools. We must overcome this stumbling block if we hope to continue to instill confidence in the traveling public and compete successfully in the global air transportation marketplace.

Workforce Challenges

Availability of Qualified, Competent Pilot Workforce

Dovetailing with the significant downturn in the aviation economy and the massive layoffs the industry experienced over the past 12 months is the necessity to develop and maintain an experienced workforce. Some furloughs experienced will never be recovered. However, we must continue to direct efforts towards ensuring that the current and future pilot workforce is the most competent that the system can muster.

The Commission's Interim Report #3, June 22, 2002, Section IV, 21st Century Aerospace Workforce, includes several recommendations to stimulate the nation's aerospace workforce. It is necessary to break the issue into two independent portions: developing a 21st century workforce and maintaining a 21st century workforce. The first part of the issue, developing a 21st Century workforce, depends on first upon re-establishing public confidence in the aviation industry. Prior to September 11, aircraft sales were at a high, capacity at the nations airports was an extremely important issue, and the public was traveling from coast to coast routinely. The industry was relatively strong. Many airlines were experiencing record profits, while others were seeing the beginning of economic hardship. Fortunately, inferior products or a lack of qualified personnel did not cause the downturn in the aviation industry. The industry, from a technical perspective, was not self-destructing. In order to develop the 21st century workforce, we must first work to re-develop the high-quality aviation industry that we had years ago. That will come from collaborative efforts to make the industry economically strong again. The goal must be to restore public confidence in our air transportation system and to streamline operations to allow the airlines to make the most of the market.

ALPA strongly feels that the aviation industry, as a whole, still has a core of technically competent individuals, capable of envisioning and creating superior products and systems to operate safely. This core group is not big enough to carry the burden of technological advancement. As the economy moves toward recovery, and employees are recalled or replaced, we must maintain the high standards of expertise and technological competence.

In 1992, the Department of Transportation established the "Pilot and Aviation Maintenance Technician Shortage Blue Ribbon Panel." The panel concluded at that time that there was no numerical shortage of pilots, and that they did not anticipate one for the next few years. They did, however, foresee an impending shortage of pilots who would meet the qualifications necessary to operate in the complex aerospace systems of the future. According to the panel, forecasts of revenue passenger miles pointed to a steadily increasing demand for pilots. The reduction of the supply, coupled with the resumption of capacity expansion, indicated that if history were allowed to repeat itself, there was a high probability that there would be another pilot shortage after several years. While not critical at the time, the panel felt that this shortage could become critical without attention, planning, action, and intervention.

The panel concluded that there are, and will continue to be, plenty of pilots who meet the FAA minimum requirements for a commercial license. However, the more pertinent issue is the question of quality, and the need to update the minimum training standards to ensure knowledge of computers, human factors, aeromedical issues, etc., in light of increasingly sophisticated equipment. We frequently hear, and agree, that airline pilots are held to a "higher standard." The minimum must never be allowed to become the target if this standard is to be maintained.

Pilot Training Advisory Board

The panel felt that a pilot training advisory board, consisting of air transportation industry and pilot training school representatives, should be convened to provide a continuing forum to devise performance-based standards for entry-level air carrier and air taxi pilots. Training organizations could use these standards to prepare pilots for careers in air transportation, and the industry would benefit from enhanced training.

This training advisory board would help air transportation "users" and "trainers" communicate their mutual needs. It also would provide an opportunity for interested parties to examine all professional pilot certification and training issues on a continuing basis. The board also felt that a baccalaureate degree reflects an excellent preparation for the intellectual demands, knowledge, and tasks required of a professional pilot. It should be considered a desirable factor in the pilot screening and selection process for entry-level air carrier pilots. This is especially true if the degree is tailored toward aeronautical knowledge and skills.

Maintaining Basic Airmanship

The industry must continue to strive to recruit and train the most qualified and competent professional pilots available. Training standards and curriculums at the many operators must be examined to determine that they contain the appropriate material to ensure that the basic airmanship qualifications are met. The ever-increasing reliance on sophisticated, automated systems to maintain and enhance safety must not, however, be allowed to substitute for this basic airmanship training. If possible, a standardized set of minimum criteria should be incorporated into each and every training programs and qualifications.

US Air Carrier Ownership

ALPA also believes that it is important to maintain the current ownership and control rules with respect to the U.S. air carriers. Those rules state that no more than 25 percent of a U.S. air carrier's voting stock may be owned by non-citizens and that, in addition, U.S. air carriers must be under the actual control of U.S. citizens.

The ownership and control rules are rooted in basic security considerations, in particular the need to ensure that U.S. air carrier aircraft are available in times of a national emergency. But they also address an important concern of U.S. airline workers -- that they receive a fair share of international flying opportunities. This concern is based on experience and a clear-eyed view of the structure of the airline industry.

For discussion's sake let us posit that Air France were to acquire and control its current alliance partner, Delta Airlines. Let us now posit there is a significant economic downturn that leads to a fall off in traffic on international routes that both Air France and Delta can fly. Which airline's flight crews -- pilots and flight attendants -- are likely to lose their jobs if Air France decides that work force reductions on these routes are necessary? Given that the majority of Air France's shares is owned by France and that French employment laws make the furlough of employees difficult and costly the answer is fairly obvious.

But we need not resort only to speculation in this area -- we have the hard lessons of experience. In the early 1990's, British Airways took a significant ownership stake in USAir. USAir subsequently gave up its routes to the United Kingdom and that flying was taken up by British Airways. When BA later divested itself of USAir's stock, it took USAir years to reestablish itself in the U.S. -U.K. market.

A similar pattern followed KLM's acquisition of a significant ownership stake in Northwest in the same time period. Northwest pilots, and I am one, saw KLM's transatlantic flying grow significantly while our company's stagnated.

The specific experiences of BA-USAir and KLM-Northwest are consistent with the data for transatlantic code-share relationships generally. That data shows that from 1993 to 2001 the portion of transatlantic flying done by the European carriers increased while the portion done by U.S. carriers decreased, and U.S. carriers placed their codes on European carrier flights to a much greater extent than European carriers placed their codes on flights operated by U.S. carriers.

These results should not be surprising. Many foreign carriers are either state-owned, as is Air France, have a legacy of state-ownership, as do British Airways and KLM. (In fact, the governments of the latter two carriers still retain "golden shares" that permit them to intervene in the operation of the airlines in certain circumstances.) They are seen as vital components of their nations' infrastructures and industrial policies. The U.S. must keep these facts in mind when responding to calls for changes in our ownership and control rules.

Compulsory Arbitration of Airline Labor Disputes

Many of you have heard about a bill being advanced by Senator McCain and others that's euphemistically referred to as "baseball style arbitration". Apparently, the bill's sponsors think that airline workers don't deserve the same rights to bargain over their wages and working conditions as virtually all other Americans. Moreover, the bill they propose is nothing like the arbitration process that's used to resolve the salaries of a few star baseball players – not the underlying collective bargaining agreement. In baseball, the basic contract and the minimum salary for players is negotiated like contracts in other industries with the opportunity for both parties to bargain freely and exercise self-help if they can't get a deal. It's only the settlement of star salaries – over the basic minimum -- that is subject to binding arbitration.

Moreover, don't we have a better employer – employee relationship and bargaining model to draw from than one that has produced 9 strikes in 9 tries in negotiations like major league baseball? I think we do. It's called the Railway Labor Act and for 75 years it has governed negotiations between union and management in the rail and airline business. The RLA has successfully produced voluntary agreement by the parties after negotiations, and sometimes mediation under the auspices of the National Mediation Board in over 95% of the time.

Air Traffic Controller Workforce

We are approaching a milestone in the evolution of the air traffic control workforce that has the potential to gravely impact the ability of the air traffic system to maintain the efficiency and capacity we have achieved. 2001 marked the twentieth anniversary of the PATCO strike and subsequent firing of the controllers. During the seven to eight years after the strike, the FAA had a large hiring and training program to rebuild the system and re-staff the facilities. Thus, thousands of controllers simultaneously began the 20 years needed to reach retirement eligibility. Now we've reached 2002 and the 20-year mark is here for many controllers and fast approaching for many more.

GAO Report 02-591, Air Traffic Control: FAA Needs to Better Prepare for the Impending Wave of Controller Attrition, June 2002, recognized and analyzed the problem of this large number of controllers all approaching retirement at the same time. The GAO report stated that the problem might be mitigated if the controllers have less mandatory overtime, the ability to work part time, and better relations between labor and management. However, while incentives to work beyond eligible retirement age would be helpful, they won't solve the problem. With air traffic predicted to increase, and with the near-certainty of mass retirements among controllers, the FAA must develop a comprehensive plan to increase hiring and to get more trainees in the pipeline.

The approximately 5,000 controllers rapidly approaching eligibility to retire mean half of the controller work force could be walking out the door and between now and 2007. Since it takes 3-5 years to train to the Full Performance Level, the time is definitely now to hire the next generation of controllers.

Obstacles to Innovation

Funding

The issues of funding the FAA and priority of spending within the FAA are always critical. The importance of air transportation to the nation's economy was mentioned above and agreement on that is universal. Supplemental funding is needed immediately to cover the FY 2002 budget shortfall of approximately $90M. The FY 2003 budget faces a larger shortfall despite requested increases. The Administration's budget proposal of $7.482 billion for FAA Operations in FY 2003 is a 5% increase but leaves the FAA projecting reductions in non-controller operational, technical, and management staffing. The loss of this talent is bound to effect NAS modernization. An increase of at least 10% is necessary to make a reasonable attempt to cover the increased responsibilities related to post-September 11 measures such as improved information security and better access control.

The FAA's Facilities and Equipment (F&E) dollars will be inadequate. The Administration's FY 2003 budget proposal of $3 billion for F&E is the maximum amount required by the AIR–21 legislation but will be approximately $100 million short of what is really needed. F&E money supports operation of existing NAS capabilities; modernization of the Nation's Air traffic Control system; a battery of projects that apply advanced technologies to garner near term air transportation system safety, capacity, and efficiency including the OEP; and, upgrading facilities to meet new security requirements, among many others.

The FAA will keep the air traffic control facilities operational. Sustaining existing capability with ATC equipment and software that is in use today and operating well beyond its intended service life will be challenging. Much of this legacy equipment has been replaced but it is trouble prone and costly to replace. In the aftermath of September 11, some equipment scheduled for replacement, such as primary radars, geographically dispersed NAVAIDs and communications systems, will be have to be maintained indefinitely. The FAA will be forced to put priority on security issues and budget restrictions will mandate less operational and technical training travel, spare parts and contractual support. The Administration's funding plan will curtail Air Traffic activities that are central to improving efficiency, for example redesign of the airspace to eliminate chokepoints, procedures to safety reduce separation between aircraft, and measures to improve traffic flow management.

Without a greater budget increase than the Administration requested, the ripple effect of an inadequate budget will be felt in the OEP work and Regulation and Certification activities. Certification is the last critical step before an aviation product is offered to the market or a cost saving, capacity enhancing operating procedure can be implemented. Certification can be an enabler of air transportation efficiency and capability, or a bottleneck, depending on the level of resources available. Short changing these vital activities is shortsighted, and where safety regulation is concerned can prove dangerous.

Reduced Airline Income

There was a period in the not so distant past in the aviation community where aircraft sales were at a high, increasing the capacity at the nations airports was an extremely important issue, and the public was traveling from coast to coast routinely. The industry was relatively strong. Many airlines were experiencing record profits. However, the current economy has caused the aviation industry to take a turn towards cost savings due to passenger decreases, operational cost increases and declines in sales. Funds within the airlines for new equipment, procedure development, and technical program development are and will continue to be reduced. These programs have been part of the airlines' corporate philosophy and structure, and without them needed short, medium and long-term capacity and efficiency improvements will suffer.

Reduced Research and Development Funding

Recent research and development funding has shown considerable emphasis on aircraft and airline security. Emergency governmental financial aid was allocated for researchers to address the security issue and operators to bring their aircraft up to a higher level of security. Programs that were fully funded in the early portions of 2001 and prior have been put at a much lower funding level due to the redirection of funds. For example, Congress initially allocated a significant amount of research funding towards the Wake Vortex Advisory System. This system is intended to aid air traffic controllers and flightcrews in determining the locations of aircraft wakes to preclude inadvertent encounters with this potentially deadly phenomenon. However, this funding was significantly cut for fiscal 2002 and beyond. These cuts may have been in direct relation to the events of last September, but as the industry begins to recover, it is important that Congress and the FAA redirect funds back to industry projects that truly will enhance the safety of the air transportation system. As noted earlier, most, if not all, of the problems in the ATC system on September 10th have not magically disappeared – they remain and now must compete with security for scarce resources.

Another example of the effect of funding restrictions on a critical safety related problem is research in the area of inflight icing conducted by the NASA Glenn Facility in Cleveland. The area of inflight icing continues to be a significant issue for the turboprop aircraft community. These aircraft tend to be exposed to detrimental inflight icing conditions for extended periods of time. Therefore, these particular aircraft types are more susceptible to dangerous encounters to icing. Unfortunately, the level of research activity is largely based upon perceived need; a need that becomes more apparent after each occurrence of an accident. At one point within the past 5 years, funding for NASA icing research aircraft was cut so severely that it was proposed that the entire program be shifted to Canada. This was an unacceptable solution to a problem that continued to manifest itself through aircraft accidents.

US Accident and Incident Investigation Process

Update the NTSB Process

As a result of the combined efforts of the Federal Aviation Administration (FAA), the National Transportation Safety Board (NTSB) and industry, the US commercial air transportation system is one of the safest in the world. The NTSB is charged with the responsibility of investigating aircraft accidents, and its ultimate goal is promoting safety through the prevention of future accidents. Industry has been investigating commercial jet aircraft accidents for half a century, and we have advanced the level of domestic airline safety to the point where the 'simple' accidents are a thing of the past. Aircraft, flight operations, and the aviation "system" have become very complex. When an accident does occur it is often the result of multiple failures within that complex "system". Because of the complexity, the investigation of accidents and incidents has become very detailed and resource consuming. If the US is to continue to improve its commercial airline safety record and concurrently make the most of its limited and valuable resources, certain NTSB processes must be updated, certain other NTSB processes must be retained despite pressures to change them and new processes or procedures must be developed. Recommended changes include increasing industry involvement in accident investigations, eliminating the probable cause statement in favor of a more balanced accounting, increasing the NTSB's incident investigation activities, and increasing the NTSB's involvement in domestic safety efforts and programs.

The Interested Party System

NTSB investigations of aircraft accidents are conducted under the interested party system. The party system is designed so that the NTSB can leverage its limited resources and personnel by incorporating additional, non-NTSB organizations into the investigation. The underlying concept is to permit the NTSB to utilize the technical expertise of the various organizations that had a role in the operation or the accident. Such organizations typically include the manufacturers, operators, the FAA, and labor associations. Members of the news media, lawyers, insurance personnel, claimants and litigants (victims or family members) are not permitted to participate in any portion of the investigation. With the exception of the FAA, party status and participation is not a right, but a privilege granted at the discretion of the NTSB based on the expertise provided.

The interested party system is subject to criticism by some. There are potential or perceived conflicts of interest inherent in the party process. The most prevalent assertion is that investigations are somehow biased or incomplete because the 'stakeholders' play a significant role in these investigations. The strongest counter-argument is that by involving all the technically knowledgeable stakeholders, there is a greater assurance that all the facts will emerge. There is no disputing the fact that interested parties are uniquely able to provide the highly technical and specific information regarding aircraft design and performance, airline operations and the myriad other disciplines required for a thorough investigation. In ALPA's opinion, the interested party system is the best in the world, and is directly responsible for the success and respect that the NTSB enjoys.

Necessity of Interested Party Expertise

In recent years, the trend has been towards more complex accidents, and has resulted in protracted investigations. Failures of complex systems cause the number of potential accident sequence scenarios to increase. Investigators and investigations must methodically explore and understand the performance of many highly integrated systems, which increases the need for technical resources and more specific and detailed skills. Again, it is only the interested parties, not the NTSB, who possess and can provide these elements.

A widely known and accepted safety tenet is that thorough familiarity with and analysis of incidents is the best accident prevention strategy. In addition, a key element in the ability to resolve complex accidents is a thorough knowledge of previous incidents. The FAA reported that in 1997, there were ten times more major airline incidents than there were major accidents. However, even though the NTSB is responsible for investigating these incidents, their resource limitations typically preclude widespread or in-depth involvement. This historically superficial investigation of incidents results in a continued inability of the NTSB to capitalize on valuable educational and accident prevention opportunities. If the NTSB is to become a more effective accident prevention entity, it is imperative that they investigate more incidents, and do so more thoroughly. The party system is ideally suited to enabling the NTSB to accomplish this objective, and must be retained.

Collaborative, Data Driven Process is Needed

Today's state of technology is such that enhanced recording technology, combined with proactive, non-punitive air safety programs such as Flight Operations Quality Assurance (FOQA) and Aviation Safety Action Project (ASAP), are enabling the accurate identification of aircraft and airspace system deficiencies. Such technology and programs can also identify procedural and human performance shortcomings. Industry and the FAA have defined and are implementing a methodical, data driven approach towards improving air safety. However, to date, the NTSB has not become involved in these (or most other) collaborative efforts. This isolationist approach hinders the NTSB's ability to maintain links with industry, consequently inhibiting the Board's communication with and knowledge of the very industry for whose safety it is responsible.

Allocation of NTSB Resources

In a similar vein, the NTSB's allocation of resources for accident investigations appears to be unfavorably skewed towards foreign accidents, at the expense of US domestic investigations. The recent RAND report on the NTSB indicated the following distribution of investigation activity:

Major domestic accident investigations - 6.9%
Major domestic incident investigations - 6.9%
Foreign investigations (with dispatch) - 17.2%
Foreign investigations (without dispatch) - 69.0%

It is unclear from the RAND report exactly what these percentages represent (number of accidents, man hours, etc), but the overall message is quite clear. A significant portion of the US NTSB attention and resources seem to be focused on safety issues outside US borders. ALPA's own experience with NTSB resource limitations and allocations substantiates these RAND figures. It is admirable that the NTSB provides assistance to the international safety community, ALPA believes that the NTSB needs to be provided with additional resources that would enable it to continue this level of "international" support and uphold its responsibilities domestically.

Review of Draft Reports by Interested Parties

ICAO Annex 13, which delineates the international standards and recommended practices for aircraft accident investigation, advocates the distribution of the draft accident report to certain participants in the investigation. This enables these participants to comment on and possibly influence the analysis and conclusions of the investigation and report. The current system in the US precludes the interested parties from participating in any analysis or reviewing and commenting on the draft report. Instead, parties develop their analyses and conclusions independently, and submit the results to the NTSB for consideration.

Although it is argued that provisions for the interested parties' review of the draft report would both decrease the NTSB's independence and amplify concerns regarding the parties biasing the outcome, it can be argued that with the current system, the NTSB is effectively not accountable to any organization for its technical analyses, conclusions and recommendations. Furthermore, while the interested party system acknowledges (and in fact is predicated on) the fact that the NTSB does not have the resources or expertise to conduct a thorough investigation, exclusion of the parties from direct or indirect participation in the development of the analysis, conclusions and recommendations antithetically presumes that the NTSB has suddenly acquired the requisite resources and expertise. Clearly, this is impossible, and ALPA advocates that the existing NTSB process be modified to permit the continued involvement of the interested parties. Ideally, this would be a system (similar to that in Canada) where the interested parties could review and comment on the draft analysis, conclusions and recommendations, the NTSB would be required to formally disposition each comment, and all this information would be incorporated into the public docket.

Probable Cause Statement

An aircraft accident is virtually never the result of a single error or failure. The series of conditions, events and circumstances that lead to an accident is referred to as the 'accident chain', and changing or eliminating any one of these items will usually prevent the accident. However, per Congressional mandate, the NTSB is charged with determining "probable cause(s)" of the accident, and current NTSB practice is to explicitly cite a probable cause statement in the conclusion of the accident report. Sometimes this statement is unembellished and unaccompanied, and sometimes it is accompanied by supporting explanations, contributing causes, or both. Other investigative agencies (such as those of Canada and Australia) report their conclusions quite differently, and generally include all causes or causal factors, typically in chronological order. As the RAND report notes:

"The statement of causation is the safety board's most controversial output. The NTSB's emphasis on probable cause as the ultimate finding from an investigation has been criticized by those who claim that the statement is too accusatory or that its scope is too limited. Probable cause sets off a chain reaction of regulatory activity... Beyond the regulatory effects, a finding of probable cause is a highly significant event for the civil litigation associated with a major commercial aviation accident."

In an ideal accident report, there would be a one-to-one correspondence between critical deficiencies, causal factors and safety recommendations, and the Canadians and Australians come closer to this ideal than does the NTSB. The NTSB (and Congress as necessary) should modify NTSB rules and practices, and eliminate simplistic probable cause statements. Instead, the NTSB should consistently strive for a comprehensive, chronological enumeration of the causal factors in the accident sequence, which more accurately reflects the complexity of the accident, and provides a more balanced description of the reasons for the accident.

Use of Onboard Recorded Information

One of the more recent 'hot topics' in air safety and aircraft accident investigation is the installation of image recorders in airliner cockpits. While cockpit imagery might prove useful in certain investigations, it is by no means the panacea that some purport it to be. There can be no argument that all pilots have a vested interest in improvements in equipment or procedures that will make their work environment safer. But like any positive change, the benefits must outweigh the detrimental effects associated with that change. With regard to cockpit imaging, the two key questions are: what will the actual air safety benefit(s) derived from such installations be, and what air safety, social (privacy) and economic costs will be incurred as a result of the installation of this equipment?

In the end, the argument can be boiled down to the singular question of whether air safety would be best served by the installation of cockpit imaging equipment. There is little doubt that image data, when used in conjunction with other investigative techniques and information, would likely aid an investigation. However, there is a strong concern that image data, when used as an investigative 'shortcut', has the potential to undermine the investigation and prevent the accurate identification of all safety deficiencies that may have contributed to the occurrence.

Data Privacy and Legal Protection of Cockpit Imaging Products

The issues of data privacy and legal protections must be addressed before cockpit imaging can even be considered. Much of the same rationale now used to substantiate the need for cockpit imaging was used 40 years ago to substantiate the need for cockpit voice recorders. Despite promises to the contrary, the accident investigation community has demonstrated that it is not capable of adequately dealing with the legal and privacy issues associated with cockpit voice recorders. Given this historical performance, how can investigators and regulators expect the piloting community to trust them with the implementation of cockpit imaging? An often expressed concern is that such lack of effective protections will inhibit investigators' ability to obtain necessary information.

Existing rules and standards do not afford the comprehensive data protection that is essential for our global industry. Although some major investigative agencies such as the AAIB, TSBC, and NTSB have treated on-board recorded information (from the FDR and CVR) with considerable integrity in recent years, the same cannot be said for investigative agencies of many other States.

Cockpit Imaging

In late 2001, the issues involving cockpit imaging were outlined in a report developed by RTCA with industry and government participation. The RTCA Future Flight Data Collection Committee (FFDCC) worked for 18 months to develop this report. Two paragraphs and Recommendations '2' and '3' from the FFDCC report are worth citing here:

"First, the provisions of ICAO Annex 13 cannot provide any security protection for recorded information unless implemented by the domestic law of the country ("State," as written in the Annex) where the accident occurred. Second, very few States have even considered the question, much less enacted laws that restrict the access of the public, the press, and certain litigants to information related to an accident. Third, as the law of the site of the accident provides the civil and criminal law of disclosure, meaningful protection is totally location dependent."

"In an industry where international boundaries are routinely crossed, current international law does not provide adequate safeguards to protect legitimate privacy and use considerations of those recorded and their employers. Therefore, some other method of protection must be developed."

RTCA FFDCC Recommendation #2: Since 1992, U.S. laws protecting CVR recording release in the case of domestic accidents have been effective. Unfortunately, the same is not true internationally. The Committee recommends that effective international protections against misuse of CVR recordings from U.S. operators be developed.

RTCA FFDCC Recommendation #3: Image recording was identified as a technologically feasible method for collecting information not otherwise recorded. The Committee recommends that issues regarding security, privacy and confidentiality be resolved, and acceptable protections be put in place prior to any action mandating image recording.

Controls on Recorded Data

Based on this FFDCC report, if industry, and in particular the regulators, is serious about exploring the installation of cockpit imaging systems, a comprehensive strategy and work program must be developed in order to adequately address all the issues discussed above. ALPA urges that the following constraints be placed on sensitive recorded information from aircraft of US registry:

> Only the NTSB would be legally or technically able to conduct readouts of the information. (Data encryption methods should render this readily feasible from a technical standpoint.). The recorded information should not ever be released outside the investigation. A narrative summary of the recorded images should be produced but not released outside the investigation.
>
> Legislation is already in place as to how CVR information can be used in tort litigation. This legislation needs to be strengthened and extended to address criminal proceedings. Similar or more stringent legislation should also be developed for image data. At the conclusion of the investigation, the recorded image information should either be destroyed or permanently retained only by NTSB.

Continued and improved air safety is highly dependent upon on-board recorded information, but meaningful data protection is completely dependent on the location of the incident or accident. In the US, these data are subject to limited protection, but that ceases to be effective once the aircraft leaves this country. The repeatedly demonstrated inability and/or unwillingness of many States' authorities and regulatory systems to adequately safeguard privileged safety information warrants a multi-layered approach to data protection. Joint technical and legislative solutions to data protection are the only way to satisfy this requirement, and aid in the improvement of air safety.

Aviation Security

During the infancy of the airline industry, the safety of flight was of paramount concern and a significant reason that the public did not choose air travel as a mode of mass transportation. Airmail pilots, who ultimately transitioned to flying passengers, flying in the years 1918 to 1926, stood a one-in-four chance of being killed in an aircraft accident. As the airline industry matured, and with ALPA's strong voice and tireless efforts beginning in 1931, air travel became the safest form of transportation in the world. This achievement was realized, in large measure, because of the relatively predictable nature of humans and machines. Advanced accident investigation techniques, human factors research, and other related disciplines, allow the airlines, manufacturers, regulators and pilots to work together to address identified deficiencies and hazards and prevent their recurrence.

However, there is no such clear path to preventing the recurrence of security breaches. A perpetrator's ability to cause intentional harm to an aircraft and/or its occupants is limited only by ingenuity, resources, and motivation. Terrorists, as has been amply demonstrated, have the luxury of time to devise means of circumventing this country's established security procedures and technologies. While much of our security focus is now on protecting the flight deck and increasing security of carry-on and checked baggage, tomorrow's threat may be completely unrelated to those issues.

Critical Security Challenges

For those reasons, therefore, our challenge is to address as many of the threats against aviation as we can, to strive to do so in a cost-effective manner, and to constantly be alert to the possibility of new and different threats. Post September 11th, it is still unclear that we understand fully how to accomplish these difficult goals – three examples of this difficulty follow:

- Each day, the media reports on yet another well-known politician, elderly war hero, or grandmother who is required to undergo illogical and unnecessary security procedures. It is, or should be, abundantly clear that a passenger profiling system is necessary to (1) recognize those of the traveling public who are trustworthy and pose little or no threat, (2) reduce the financial outlays for security screening of people and their possessions by focusing on the "unknown" passenger and (3) make air travel a more pleasant, more popular, and less fatiguing form of transportation. Although some may oppose any method of identifying an individual that implies that someone else is less trustworthy, it seems most logical to do so and would be genuinely effective.

- Last fall, Congress established a very worthy goal of screening all checked baggage by the end of this year using the most current technology Explosive Detection Systems (EDS) in use at that time. Although this goal is one that we have supported in concept, recent information indicates that the technology in view during deliberations and passage of the Aviation and Transportation Security Act is already "old" technology. Policy study 297 (attached) of the Reason Public Policy Institute states that "baggage-screening technology is a field that is in flux; much better systems are likely to be available in the next few years, making it unwise to make multi-billion-dollar investments in mediocre technology today." It further states that "the focus of baggage inspection should be shifted from detecting objects to identifying high-risk passengers – and matching inspection technologies to those risk groups." One startling fact from that report makes it clear that further deliberations are needed now to avoid making very expensive mistakes – the cost of 6,000 EDS's installed at airports is approximately $12 billion. For purposes of comparison, the entire FBI budget is $4 billion annually.

- The aviation industry is "compliance-driven" rather than "threat-driven." What this means is that regulated airports and airlines are given a checklist of things that they must do to make their assets and passengers secure. A "cookbook" approach to security does not require or encourage, indeed it hampers, the creativity of airline and airport security personnel in addressing the threat(s). This was amply demonstrated by the events of September 11th, because virtually no one had envisioned the use of box cutters to hijack an aircraft, or the other tactics employed by the terrorists on the aircraft – as a result, no one was prepared to counter them. What is needed, instead of a regulatory checklist, is an assessment of threats for each airline operation and airport and a requirement that the regulated parties creatively develop and implement measures aimed at thwarting those threats. The TSA's inspection function should be used to test whether actual threats would be successfully countered under real conditions.

Rapid Response Teams Recommendations

Immediately after the attacks last September, the aviation industry reacted to the newly identified threats to our lives and livelihoods. Transportation Secretary Mineta formed a commission to address, in short order, the many security deficiencies that were known to exist at that time. Rapid Response Teams were established, comprised of members of all areas of the aviation community; regulators, manufacturers, flight crews, cabin crews, researchers, et al. These teams were used to evaluate each aspect of the new threat and work on solutions to them. The teams worked long hours to develop many valid recommendations for legislative and regulatory actions.

Rulemaking has been implemented for enhanced flight deck doors that meet or exceed improved intrusion and penetration standards. As you may be aware, the deadline for installation of these improved doors is April 2003. Regulatory language is being drafted to ensure continuous emergency notification from an aircraft. Regulatory language is being drafted to afford flightcrews with the ability to monitor the cabin for adverse activity. Regulatory language has been put into place to further limit the individuals that will have access to a cockpit jumpseat. New baggage and passenger screening procedures have been implemented throughout the United States to identify and eliminate the threat much earlier in the process.

All of these systemic and hardware changes are intended to minimize the possibility of another encounter with a terrorist planning on using a **passenger** carrying aircraft as a weapon. The word passenger is emphasized since a majority of the changes mentioned above are specifically associated with passenger operations only. Serious holes continue to exist in the industry's activities related to aircraft security.

One Level of Security is Essential

Several years ago, ALPA embarked on a campaign entitled One Level of Safety. That effort was highly successful in bringing to the attention of the traveling public, elected officials and the aviation industry the need for significant safety improvements to small airline aircraft operations. As a result of those efforts, smaller airline aircraft now meet the same, or equivalent, standards of the largest aircraft in the fleet.

The security in place prior to September 11th was, by design, of differing levels. The rationale behind those disparate levels of security was that the threat posed to small aircraft was thought to be less than that posed to large aircraft. The dangers associated with operating at small airports were thought to be less than the risks at large airports. The hazards posed by service personnel carrying items around the screening checkpoint were, curiously, thought to be of less concern than those associated with uniformed crewmembers going to their aircraft. For the most part, we even felt that the threat to domestic flights was less than the threat to international flights. And we believed that the threats to cargo aircraft were minimal.

We now know that those assumptions must be discarded so that we can get about the work of preventing any further acts of aircraft piracy and other acts of malice. It is clear that any size aircraft flying from any size airport, international or domestic, can be used as a human-guided weapon of mass destruction. Accordingly, we believe that in order to create a truly secure aviation system, we must start with the principle that the traveling public and aircraft crewmembers need *one level of security*, no matter where they fly and regardless of the size or mission of the aircraft in which they travel.

Cargo Aircraft Security

Cargo aircraft are almost completely forgotten from the industry's thinking about security. Keep in mind that the devastation caused on September 11 was a function of the size of the aircraft and the fuel required to complete the mission. For this reason, cargo aircraft are an equally dangerous threat, capable of inflicting the same level of damage. The new regulations related to flight deck security apply only to cargo aircraft that had a cockpit door installed on the date of the rule. Aircraft that did not have a door installed or had their door removed prior to the date of the rule are exempt from the installation of hardened doors by April 2003. This is a significant hole in aircraft security. Cargo aircraft continue to carry individuals necessary to maintain some types of cargo (i.e. animal trainers and handlers, groomers, etc.). Company employees are also included in the list of additional personnel that are permitted to travel on these aircraft. Without a cockpit door being required on ALL cargo aircraft vice simply those that had one installed on a specific date, the integrity of the cockpit could be compromised. We must remember that it was not too many years ago when a company employee at a major cargo carrier attempted to hijack an aircraft and use it as a weapon. Fortunately, the flight crew was able to thwart the attempt, but not without a struggle that caused significant injury to everyone onboard. Enhanced flightdeck security procedures must be implemented on cargo aircraft as well to maintain the integrity of the cockpit, the aircraft, and property on the ground.

Another shortcoming to the enhanced security measures is their applicability to small passenger carrying aircraft (i.e. less than 20 seats). These aircraft, which were not required to have any cockpit doors installed prior to the post-9/11 door regulations, are still exempt from the cockpit door requirement. Although the smaller passenger carrying aircraft are incapable of causing such widespread damage as the World Trade Center or the Pentagon, a properly targeted small aircraft could inflict significant damage.

The Cost of Security

These enhanced security measures do not come cheaply. Cockpit doors for the large aircraft are costing upwards of $35,000 per unit. Cabin surveillance equipment will also be a costly item for the operators. But we feel that this is the price to pay for a secure air transportation system. This is a necessary cost to restore public confidence. This is a small cost to pay to ensure that our aircraft, that are part of the safest air transportation system in the world, do not fall into the hands of terrorists to be used against us again. The cost of such critical improvements cannot be used as justification for their delay.

The Future of Security Work

The future of aviation security depends upon what the industry does right now while the issues are fresh in everyone's minds. The regulatory language of January 2002 related to flight deck security must be amended to mandate the installation of secure cockpit doors on all aircraft being conducted as FAR Part 121 passenger and cargo operations. The aviation industry was successful in 1995 when we achieved One Level of Safety for all passenger-carrying operations. Let's make 2003 the year that we established One Level of Security for our traveling public also.

Needed Long Term Development

The NAS incorporates all elements of aviation, not just the FAA. The major conceptual breakthrough required for the future NAS is the move from a system for which the main purpose is to minimize delays when demand exceeds capacity to a system for which the purpose is to increase capacity and efficiency of the entire NAS under all conditions. Successful implementation depends on the involvement and participation of the users in the development process and the associated fielding of new concepts and systems. This process mandates a cooperative exchange of information among all users and service providers. Flexibility in the process will allow service providers and users to arrive at both safe and economical solutions to a variety of situations.

Even when technology may allow realization of new capabilities now, resource consideration will play a major role in determining the rate at which the NAS evolves from today's system to the system of the future. Resources refer not only to the FAA's ability to expend funds on research, development, acquisition and operations, but also extends to the ability of the users to procure and install the necessary avionics and conduct the necessary training on new procedures to take advantage of new capabilities that become available.

Aircraft Equipage and NAS Modernization

The challenge of arriving at a viable transition strategy follows directly from the discussion on resources. As the NAS evolves, it must continue to provide at least the current level of services. This leads to the necessity of operating and maintaining parallel and redundant systems, particularly on the part of the service provider. Such parallel operations are expensive and divert resources from other initiatives that could otherwise provide new capabilities. The duration of dual operations is related to how rapidly the different airspace users equip with new avionics. The uncertainty of the equipage rate and the length of the dual operations period is a challenge that the FAA and the user community must collaboratively address.

Research &Development

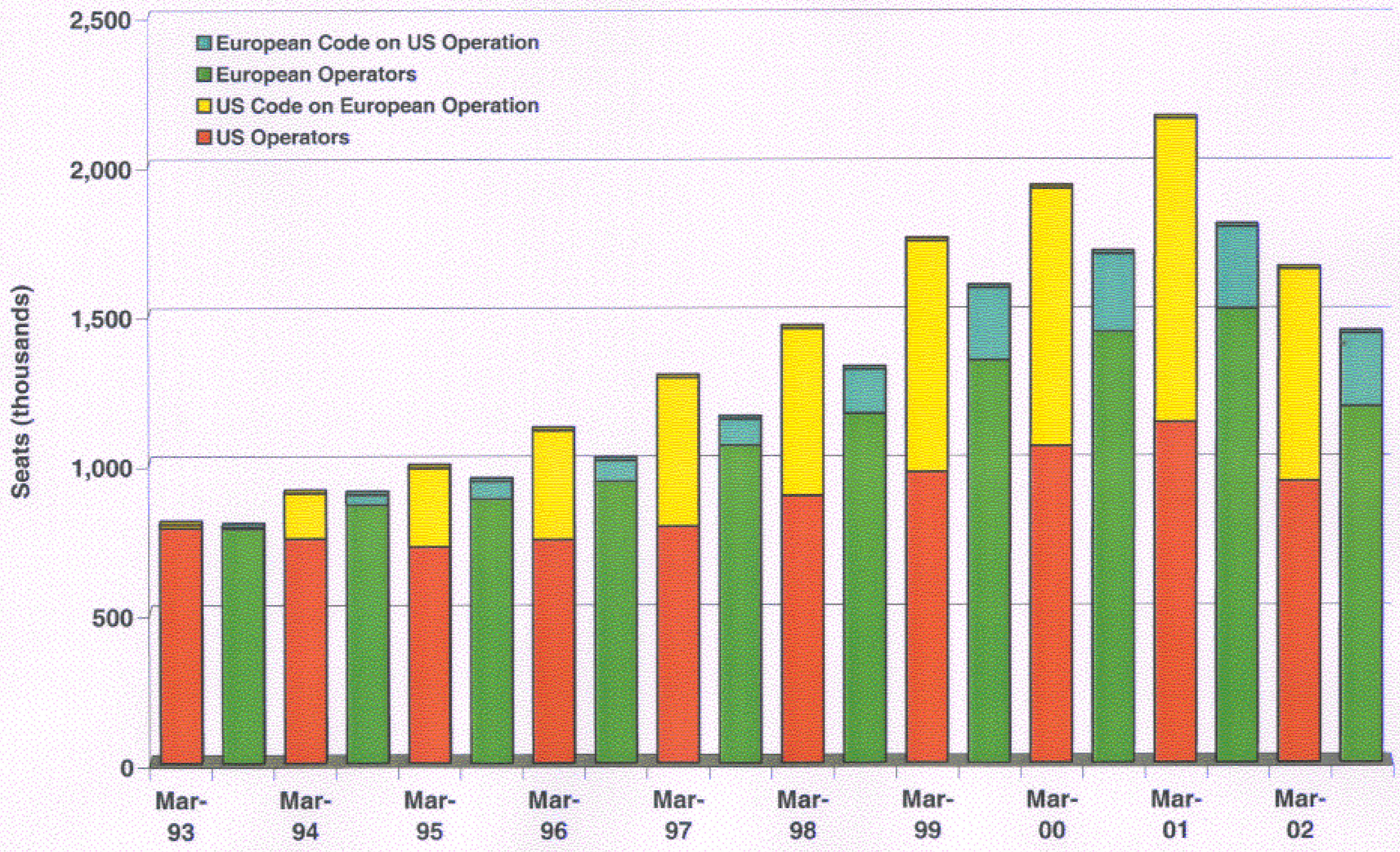
In moving forward in research and development areas, the approach must consider several key elements from the start. Economic issues are of critical importance. Research and technology development must have in mind affordability and upward compatibility - the capability of low-cost upgrading of equipment and systems, where even the first generation technology is designed for future retrofit. Systems must also be developed such that economic incentives to adopt new systems and install new equipage are built in from the initial design. The research and design process must also become more fully aware of, and integrated with, the certification processes that will be required. The time needed for certification must be reduced, including working to develop better, more coordinated certification paradigms which allow the certification process to be accomplished in parallel with system/software/equipment development. This process really needs to begin in the research stage. Equally important, the research and development process must be grounded in an environment that is fully cognizant of the operational concepts that the research is ultimately intended to address. This is needed to avoid the divergence of technology development from the requirements of the operational concept being implemented and avoid the "solution looking for a problem" syndrome.

CNS research today is fragmented, often uncoordinated and of low visibility, existing as parts of other programs and often considered as "someone else's problem". The traditional approach of separate systems, separate equipment, separate communications links, separate frequencies, etc. to address individual applications and operational needs must be replaced by an over-arching approach of CNS as an integrated network of systems. The CNS research and development community must have its own identity as the most important infrastructure through which the 2020 operational vision is enabled.

In order to raise the level of visibility of the CNS research and development, to provide focus and guidance to the research, to coordinate and harmonize different research efforts to achieve a common goal, and to garner the necessary resources, a CNS research and development coordination committee or committees must be formed. The committee must have both a national and international focus and be associated with and include membership of the key organizations responsible for aviation system research and development including the FAA, NASA and Eurocontrol. The committee must be able to operate at sufficiently high levels within these organizations to draw attention to critical issues and gain the necessary support and resources to properly address such issues. The input of the aviation user community is of critical importance to this effort. The committee must be able to foster creative, credible, high quality and high value research and interact with the entire aviation community.

Attachment: Rethinking Checked-Baggage Screening, Reason Public policy Institute, July 2002
Attachment: Code Share Seats graphic comparison, March 1993 – March 2002

Monthly Seats March 1993 to March 2002
by Operator Country - US to Europe



July 2002

Reason

Rethinking Checked-Baggage Screening

By Viggo Butler and Robert W. Poole, Jr.

POLICY STUDY

297

Reason Public Policy Institute

A division of the Los Angeles-based Reason Foundation, Reason Public Policy Institute is a public-policy think tank promoting choice, competition, and a dynamic market economy as the foundation for human dignity and progress. Reason produces rigorous, peer-reviewed research and directly engages the policy process, seeking strategies that emphasize cooperation, flexibility, local knowledge, and results. Through practical and innovative approaches to complex problems, Reason changes the way people think about issues and promotes policies that allow and encourage individuals and voluntary institutions to flourish.

Reason Foundation

Reason Foundation is a national research and education organization that explores and promotes the twin values of rationality and freedom as the basic underpinnings of a good society. Since 1978, the Los Angeles-based Foundation has provided practical public-policy research, analysis, and commentary based upon principles of individual liberty and responsibility, limited government, and market competition. REASON, is the nation's monthly magazine of "free minds and free markets." It covers politics, culture, and ideas through a provocative mix of news, analysis, commentary, and reviews.

Reason Foundation is a tax-exempt organization as defined under IRS code 501(c)(3). Reason Foundation neither seeks nor accepts government funding, and is supported by individual, foundation, and corporate contributions. Nothing appearing in this document is to be construed as necessarily representing the views of Reason Foundation or its trustees, or as an attempt to aid or hinder the passage of any bill before any legislative body.

Re-Thinking Checked-Baggage Screening

By Viggo Butler and Robert W. Poole, Jr.

Executive Summary

Current law mandates that all checked bags at 429 passenger airports be screened by explosive detection systems (EDS) or alternative means by December 31, 2002. Because it will not be possible for manufacturers to produce the number of EDS machines required by that date, nor for airports to design and build the major facility modifications that would be needed, the Transportation Security Administration has called for an interim approach using a combination of EDS and explosive trace detection (ETD) machines. Both the original mandate and this interim approach to meeting it are seriously flawed.

EDS is a flawed technology. Its error rate (false-positives) is nearly 30 percent, and its throughput is a low 150-200 bags per hour under real-world conditions. Meeting the 100 percent inspection requirement solely with EDS, when taking into account peak-load conditions, machine down-time, and other constraints, would require over 6,000 machines, at a total cost of $12 billion ($6 billion for machines and $6 billion for facility modifications). TSA's proposed alternative—ETD—is even slower than EDS, and is much more labor-intensive. An all-ETD system would cost $3 billion, would require 50,000 people to operate, and would require more space than an all-EDS system. The only other approved alternatives—hand search and dog-search—are also slow and very labor-intensive.

TSA's estimated budget for this year is $8 billion—to cover all security threats to all modes of transportation. It will soon become part of a $37 billion Department of Homeland Security, which will address all domestic security threats. To focus up to $12 billion on inspecting airline baggage seems hugely disproportionate, given the enormity of the task of defending this country against terrorism here at home.

Congress should revisit the baggage-inspection issue, drawing on the experience of Europe and Israel, which have many years of experience in dealing with terrorist threats to aviation. The two key points guiding this rethinking are:

- Baggage-screening technology is a field that is in flux; much better systems are likely to be available in the next few years, making it unwise to make multi-billion-dollar investments in mediocre technology today.
- The focus of baggage inspection should be shifted from detecting objects to identifying high-risk passengers—and matching inspection technologies to those risk groups.

In the technology area, Congress should appoint a Blue-Ribbon Committee to provide technical expertise to TSA in the airport security field. This committee should review new baggage-inspection technology that is coming into use, or being approved for use, in Europe. Some of that technology appears to offer a better combination of performance and cost than EDS and ETD for mass-baggage screening, at least on an interim basis. But the committee should also recommend high-priority investments in research and development on advanced explosive-detection technologies that could replace the current generation of EDS machines.

Congress should also mandate a shift of focus in baggage and passenger inspection, making the *detection of high-risk people* the guiding principle. That means using the computer-assisted passenger pre-screening (CAPPS) system and a registered traveler program to sort passengers into at least three different risk groups—and matching baggage-inspection technologies appropriately to each group. Slow and costly technologies like EDS and ETD would be used for all passengers in the highest risk groups and on an on-exception basis for others. As in Europe, baggage processing would involve several tiers or levels, with all bags going through relatively high-speed Level 1 inspection, but only questionable bags or those from high-risk passengers going on to Level 2 or Level 3 inspection.

To implement these changes, Congress would have to take the following steps:

1. Extend the deadline for 100 percent checked-baggage inspection to December 2004;
2. Have TSA approve a shift to a multi-tiered (in-line) baggage inspection system;
3. Create a Blue-Ribbon Commission on airport security technology to make recommendations on both immediate and medium-term R&D investments; and
4. Encourage FAA to certify additional baggage-inspection technologies for implementation between now and December 2004, such as some of those approved for use in Europe.

Table of Contents

Part I

Introduction

In November 2001, Congress enacted the Aviation and Transportation Security Act (ATSA). Among other things, that law requires that the head of the new Transportation Security Administration within DOT "take all necessary action" to ensure that all checked luggage at the country's 429 leading passenger airports be screened by explosive detection systems (EDS) by December 31, 2002. While the intent of the law was to have every such bag pass through a $1 million machine that uses CT-scanning technology, the drafters of the measure recognized that this demanding goal might not be possible to meet. Thus, the law provides that "if explosive detection equipment at an airport is unavailable, all checked baggage is [to be] screened by an alternative means."

Airline, airport, and technology experts have raised serious concerns about:

- the ability of manufacturers to produce enough EDS machines to meet the mandate by the end of this year;
- the ability of airports to find the space to install these large machines;
- the ability of TSA to fund, manufacture, and install conveyor systems to accomplish in-line screening;
- the availability of sufficient funds to produce, install, and adequately staff the thousands of EDS machines that would be required; and,
- the reasonableness of purchasing existing equipment when apparently superior technology is expected to be available over the next few years.

On March 4, 2002, DOT Secretary Norman Y. Mineta announced that the TSA would use EDS machines in combination with another, lower-cost technology: explosive trace detection (ETD) systems.

This policy brief calls for a re-thinking of the current approach to checked-baggage screening. It reviews the array of currently available technologies, including the cost, speed, and accuracy of each. It also reviews European baggage-screening practices. It concludes that even if it were possible to meet Congress's Dec. 31 deadline in its strong form—putting every single checked bag at 429 airports through an EDS machine—it would not be wise to do so. It calls instead for a different approach to baggage screening, based in part on the extensive experience of Europe and Israel, both of which have been dealing with serious terrorist threats far longer than the United States.

Part 2

What Inspection Technologies Are in Use Today?

Five principal means of inspecting checked baggage for explosives are in use at airports today. They are: hand search, explosive-sniffing dogs, automated X-ray machines, explosive trace detection (ETD) systems, and explosive detection system (EDS) machines. They differ widely in cost to acquire, operating cost, processing rate, and accuracy (both false positives and false negatives). All five of these factors must be taken into account in deciding what technology or combination of technologies makes sense to use.

A. Hand Search

The oldest method of baggage inspection is to open each bag and search it by hand, using a trained operator. A major disadvantage of this method is that it is slow; since hand inspection takes two to five minutes per bag, the throughput rate is from 12 to 30 bags per hour. In addition, should the bag actually contain an explosive device, there is a danger that it will detonate when the bag is opened or when the device is disturbed. That, in turn, suggests that hand searching be done in a secure area, away from concentrations of passengers.

B. Explosive-Sniffing Dogs

As of the beginning of 2002, the FAA had 175 trained dogs, operating at 39 U.S. airports, for explosive-detection purposes. Such dogs can work for up to two hours at a time, but must take breaks every 20 minutes. Their sensing ability apparently decreases in repetitive duty such as routine bag inspection; their preferred use is for checking an airplane or terminal in the event of a bomb threat, or as a second-tier inspection device for a bag flagged as needing further scrutiny. The FAA's William J. Hughes Technical Center has sponsored tests of dogs' ability to detect both plastic and non-plastic explosives, though critics point out that none of these studies were double-blind (i.e., in which the handler did not know which bag contained an explosive sample and was therefore unable to, perhaps inadvertently, provide cues to the dog). It costs about $20,000 to purchase, train, and certify a new canine. The TSA provides airports with $40,000 per year per dog team, but the total annual cost exceeds $50,000 at most airports. To increase the number of trained dogs from 175 to 300 (and expand their use to 80 airports), the agency budgeted an additional $5 million for 2002.

C. Explosive Trace Detection (ETD) Machines

These machines can detect minute traces (e.g., a millionth of a gram) of explosive residue picked up on a swab. The swab is inserted into the machine, which heats it and samples the vapors for specific chemicals. Trace detection has been in use for some time, on a random basis, at passenger screening checkpoints, to check the outside of selected carry-on bags for explosive residues. Closed Bag trace detection was used at Salt Lake City Airport during the 2002 Olympics, in combination with EDS machines, to become the first U.S. airport at which all checked bags were subjected to some form of explosive-detection screening. Used that way, trace detection averaged 47 seconds per bag, which equates to a throughput of 76 bags per hour. Salt Lake City had to hire nearly 400 additional screeners to implement the system, more than doubling the screening workforce.

Two other forms of trace detection take longer to carry out. Open Bag trace samples both the outside of the bag and the inside lining. That takes about 2 to 2.5 minutes per bag. "Non-directed" trace[1] samples the outside, inside lining, and each item larger than a soft-drink can. This process was found to average 3 to 4 minutes, in FAA tests at Omaha and Stewart airports. Staffing requirements are directly proportional to the time required. Thus, Open Bag trace detection would require 2.8 times the work-force of Closed Bag, and Non-Directed Open-Bag would require 4.4 times as many inspectors.

The TSA reportedly plans to mandate a 40-40-20 procedure for ETD, under which 40 percent of bags would be processed as Closed Bag, 40 percent as Open Bag, and 20 percent as Non-Directed. Serious concerns have arisen about the effectiveness of this approach for mass screening.[2]

D. Automated X-ray Machines

In Europe, where 100 percent checked-luggage screening is close to being a reality, most airports use basic automated X-ray systems for the first level of baggage screening. While not as accurate as EDS machines, they are much faster and much less costly. Typically, they operate at a rate of 1,200 to 1,500 bags/hour, seven to 10 times as fast as EDS under real-world conditions. Bags flagged by the automated system as "questionable" are sent to a second X-ray machine, where a human operator reviews the image on a screen. Those bags not cleared by this second look are routed to an EDS machine. Thus, the initial automated X-ray machine is not sufficient by itself. But it permits the slow and expensive EDS machines to be used only for exceptional bags. Among the airports relying on such layered systems for 100 percent bag screening are Athens, Heathrow, and Manchester. Automated X-ray machines are not currently certified for use at US airports.

E. EDS Machines

The term "EDS" (explosive detection system) currently refers to sophisticated million-dollar machines that use computerized tomography (CT) technology similar to that used for CAT scans in hospitals. By taking the equivalent of hundreds of X-ray pictures of a suitcase from different angles, the device can create three-dimensional views of what is inside, including some indication of the relative density of objects. A trained operator can then spot items likely to be explosives. Current EDS machines weigh six to eight tons and are the size of a minivan; their processing rate is a slow 150-200 bags/hour under real-world conditions. And their rate of false-positives (flagging an item as an explosive when it is not) is around 30 percent. The high cost, large weight and space requirements, slow processing rate, and high false-positive rate have all caused concern, as has the operator's ability to reliably evaluate the X-ray picture. Some EDS machines have a down-time of up to 30 percent (as experienced at SFO's new international terminal).

F. Comparison of Technologies

To pull all of this information together, Table 1 compares the five technologies on their principal characteristics. The ideal system would have a high processing rate (bags/hour), and low initial and operating cost, while also having low rates of false readings. Note that there are two different kinds of errors which any such system can make.

- A *false positive* reading is what occurs when the system identifies a substance as explosive material when it is not. This is a problem because every such false reading leads to additional steps being taken, which slow things down, inconvenience passengers, and cost money. Such steps can include having the bag re-inspected by a different kind of system all the way to evacuation of all or a portion of a terminal. The false positive rate of EDS is particularly troubling.
- But also very important is the *false negative* rate. A false negative occurs when explosive material is actually present but the system fails to recognize it. Ideally, the false negative rate will be very close to zero, if not for a single alternative then for the set of alternatives used together as a system.

The table presents a sobering picture. The only alternative that permits speedy processing, compatible with scanning millions of checked bags, is the automated X-ray machine, which was not certified for use at U.S. airports due to the high false-negative rates of earlier versions (although one such machine is apparently now close to being certified by the FAA). Yet the next-fastest alternative is the very expensive—and still not very good, as measured by its false-positive rate—EDS machine. The other alternatives—dogs, hand-search, and trace—are much slower and have their own limitations. In short, the technology to reliably screen massive numbers of bags, at reasonable cost, is simply not available yet.

Table 1: Comparison of Baggage Inspection Alternatives

Type	Bags /hour*	False Positive Rate	False Negative Rate	Initial Cost/ Unit	Unit Operating Cost/Year
Hand Search	12-30	n.a.	n.a.	$0	$45K
Dogs	400	n.a.	n.a.	$20K	$50K
Trace (Closed)	76	n.a.	30-50%	$450K	$90K
Trace (Open)	24-30	n.a.	15%	$45K	$90K
Trace (Non-directed)	15-20	n.a.	15%	$45K	$90K
Automated X-ray**	1,200-1,500	n.a.	n.a.	$250-400K	$90K
EDS Machine	150-200	30%	n.a.	$1,000K	$510K

*not including time to "clear" false positives

**not certified for use in the United States, though approved in Europe

n.a. = no generally accepted figure available.

Part 3

Problems with the 100 Percent Mandate

A. Limitations of EDS and Trace Machines

EDS machines currently have a bag-rejection rate of around 30 percent—and as high as 50 percent in some locations. Bag rejection means that an item is either suspicious or the operator cannot identify it. (Since virtually all of these items are eventually cleared, this number is essentially the same as the false-positive rate given in Table 1.) For some items, the EDS machine cannot discern a difference between common products and known threat items. With a projected rate of 1.5 billion checked bags per year, a rejection rate of 30 percent means 450 million bags per year—more than 1.2 million per day. These bags all need either further screening by another technology or hand search. In either case, the additional machine, time, and labor requirements for more-intensive additional screening of more than a million bags per day are very onerous.

EDS technology is likely to improve somewhat in coming years, but appears likely to have an inherently high rate of false positives. Hence, it is unlikely to ever be the stand-alone silver bullet solution for baggage screening. If used as the first line of defense, it will have to be back-stopped by additional costly technology using other principles. And its inherently slow throughput and high cost makes it a poor choice for mass screening of bags.

Trace (ETD) systems currently require hand labor for each bag. When used solely on the outside of a bag (Closed-bag), ETD has unacceptable false-negative rates (i.e., failing to detect explosive materials inside up to 50 percent of the time). But opening each bag triples or quadruples the inspection time, leading to very low throughput rates. Low flow rates will cause long lines and airline delays. Therefore, huge numbers of ETD machines and operators would be required if ETD were to be used (as TSA has proposed) as a mass-screening method. Furthermore, ETD does not detect some items, even in open-bag inspection mode.

Moreover, although TSA has announced large-scale purchases of ETD machines for airports, this technology "does not meet, nor was it ever intended to meet, the FAA's rigorous EDS certification standards," according to *Aviation Week*.[3] TSA has asked the FAA's Technical Center in Atlantic City to develop certification standards for ETD in large-scale bag-clearing operations, but the needed tests will not be completed by the Dec. 31 deadline for implementing 100 percent screening. *Aviation Week* also notes that the National Academy of Sciences has called on the FAA to evaluate the effectiveness of these machines, based on a 1996 finding that the "problem in all trace-detection approaches is clearing vapors or particles of explosive materials from the sample-collecting mechanism so that subsequent readings are not influenced by previous traces of explosive materials."

B. Excessive Cost

If the current EDS and ETD technologies were highly effective, they might be worth paying the many billions of dollars required to meet the December 31 mandate for 100 percent checked-baggage inspection. But the very real limitations of these technologies, noted above, call into serious question the wisdom of such a crash program. In this subsection, we review available cost estimates.

Since the ultimate TSA plan calls for an unknown mix of EDS and ETD machines, we can get outside limits of the cost by looking first at all-EDS and all-ETD systems. The most common all-EDS figure is approximately 2,000 machines, at $1 million each, for an equipment cost of $2 billion. The Inspector General's estimate of terminal facility modification costs to accommodate that number of machines is another $2 billion[4], for a total installed cost of $4 billion. However, the Rand Corporation's analysis found that a more realistic estimate for an all-EDS system is 5-8,000 machines.[5] Using a figure of 6,000 machines, and adjusting the building modification costs accordingly, increases the total cost of an all-EDS approach to $12 billion. The IG's estimate of staffing for a 2,000-machine system is 22,670. If we assume a burdened annual cost of $45,000 per FTE, that leads to a staffing cost of $1 billion/year for a 2,000-machine system. For the Rand-estimated 6,000-machine system, the staffing would not be three times as great, because Rand's analysis takes account of machine down-time and includes significant spares. But staffing would be at least double the IG's estimate, say $2 billion/year.

The other extreme would be an all-ETD system. While no estimate of the number of machines required nationwide for an all-ETD system could be located, it is possible to make an educated guess. Unpublished analysis by an airport planning firm, based on simulation modeling for a medium hub airport, found that each ETD machine would require one operator (Open-Bag), and we do have the IG's estimate that an all-ETD system needs 50,480 FTE to operate it. Assuming this number to represent two shifts per day, that's two FTEs per machine. Hence, the derived number of ETD machines is 25,240. At an acquisition cost of $45,000 each, that totals $1.14 billion. The same airport planning firm found that an all-ETD system would take up more space than an all-EDS system handling the same baggage load. If we assume this means 1.5 times as much, and apply that factor to the IG's $2 billion facility cost estimate for an all-EDS system, the facilities cost for ETD would be $3 billion. Thus, machines plus facility cost would total $4.14 billion for all-ETD. Assuming the same burdened cost of $45,000 per FTE, the annual staffing cost would be $2.3 billion.

Tables 2A and 2B summarize the calculations of capital costs and staffing costs for the two alternatives. Late in April the TSA announced that its interim plan for complying with the December 31 deadline would be a mix of 1,100 EDS and 4,700 ETD machines. Because this combination requires fewer machines, fewer staff, and less facility modification than either of the above alternatives, this less-capable compromise will cost significantly less. Using the same cost factors as in the above analysis, we can derive the figures in the third column of Tables 2A and 2B. As can be seen, the TSA's interim approach should cost in the vicinity of $3 billion to implement and about $1 billion per year to staff, with a 22,000-person workforce.

Table 2A: Capital Costs for Meeting Dec. 31 Baggage-Screening Mandate ($billions)			
	All-EDS	All-ETD	TSA Interim
Number of EDS	6,000	0	1,100
Machine cost	$6.0 B	0	$1.1 B
Facility costs	$6.0 B	0	$1.1 B
Number of ETD	0	50,480	4,700
Machine cost	0	$1.14 B	$0.212 B
Facility costs	0	$3.0 B	$0.559 B
Total capital cost	$12.0 B	$4.14 B	$2.971 B

Table 2B: Annual Staffing Costs for Meeting Dec. 31 Baggage-Screening Mandate ($billions)			
	All-EDS	All-ETD	TSA Interim
Number of EDS staff	45,340	0	12,468
Number of ETD staff	0	50,480	9,400
Total staff	45,340	50,480	21,868
Annual staff cost	$2.04 B	$2.27 B	$0.984 B

These cost figures are very sobering. At the very least, they suggest a pause for rethinking, to put them in perspective relative to other federal expenditures on dealing with terrorism. The entire FBI annual budget is in the $4 billion range, and the TSA budget for 2002 (for all transportation security) is approaching $8 billion. Does it really make sense to spend between $3 billion and $12 billion just on airline baggage inspection systems and another $1-2 billion per year operating them? That compares to extremely modest sums currently going toward inspection of the millions of cargo containers that enter U.S. ports every year, virtually none of which are being inspected. The forthcoming cabinet agency for homeland security will have an initial budget of $37 billion, including TSA's $8 billion, to deal with the entire range of security threats—to buildings, water supply, power plants, population (chemical, radiological and biological attacks), etc. It seems hugely out of proportion to be spending up to $12 billion on airline baggage inspection, when the full scope of security threats is so enormous.

C. Unrealistic Schedule

The fact that the two FAA-certified manufacturers of EDS machines could not possibly produce 2,000 of them by December 31, 2002 was a principal factor in the DOT's decision to order instead a mix of EDS and ETD machines. But even installing the interim mix of 1,100 EDS and 4,700 ETD machines by December 31 is highly problematic. Even if this large quantity of machines can be produced and delivered before the end of the year, the major challenge is making facility modifications at the airports which will be receiving them.

As noted previously, while individual ETD machines are much smaller than EDS machines, a much larger number of them is required, given their even slower throughput. Design studies at some airports are showing lobby-based ETD installations taking up more space than the entire existing lobby, requiring expansion of the building. Those airports planning lobby installation of more than a few EDS machines face similar problems of lack of space, as well as the need to strengthen floors to handle the massive machines. And while it appears that the majority of airports are now planning to install EDS machines in-line, as part of their baggage processing systems, in many cases that will require either the construction of an entirely new building or at least an expansion of existing buildings.

These are not quick or simple terminal remodelings; they are major construction projects. The DFW Airport has estimated that expanding its semi-circular terminals to integrate 40 EDS (plus 20 spares) and 157 ETD machines will cost $193 million.[6] Port Authority of New York and New Jersey officials now estimate that facility modification costs at Newark will exceed $100 million.[7] Even mid-size airports are faced with sizeable construction projects. Louisville, San Jose, and Tulsa are each planning separate buildings to house their EDS machines, at costs ranging from $14 million (Tulsa) to $80 million (San Jose).[8]

Given the lead time involved with large construction projects (design, equipment ordering, environmental review [if required], construction, installation and testing of equipment, etc.), a realistic deadline for reconfiguring entire baggage systems with new equipment and facilities would be two and a half years from the decision point. Thus, if a decision were made this summer to adopt the revised approach outlined in this report, a revised deadline for improved checked-baggage inspection systems would be December 31, 2004.

Part 4

Rethinking the Mandate: An Alternative Approach

Two key points underlie our proposed alternative approach. The first is that the existing technology for explosive detection is relatively poor. Even if the $12 billion needed for an all-EDS approach were readily available, it would not make sense to spend this kind of money buying mediocre technology and making major modifications to passenger terminals across the country. Promising alternatives are under development, which may be available in a few years offering better performance at lower cost. And investing a small fraction of that $12 billion now in strategic R&D on promising technologies is likely to be a far better investment than premature spending on poor technology.

Second, the current approach of focusing 100 percent of inspection resources on 100 percent of passengers is fundamentally flawed. Rethinking this premise, and drawing on the experience of other countries, can lead to a smarter approach to checked-baggage inspection that targets resources to where they are most likely to be useful. This approach focuses more on *people* than on *objects*.

A. Invest in Better Inspection Technology

Instead of massive and rapid deployment of today's mediocre technology, and the accompanying major disruption to the country's airports, a more measured and moderate approach is called for. Congress should authorize and fund a Blue Ribbon Committee of industry, research, and security leaders to develop a path toward the best medium-term solution and the most promising areas for new-technology development. Strategically investing in R&D a portion of the $12 billion that might otherwise be spent on too-hasty deployment of imperfect EDS machines would be a far wiser use of those funds.

This committee should take an immediate fresh look at the latest technologies approved for use at European but not in U.S. airports, considering the overall trade-offs involved. Here are several examples:

- **Backscatter X-ray** (American Science & Engineering): This technology is currently employed by the U.S. Air Force to screen baggage and parcels before flight, as well as at some airports in Europe.
- **Coherent Scatter** (Yxylon International, Heimann Systems): This technology is in use in Germany at Cologne, Dusseldorf, and Munich airports, for Level 2 and Level 3 screening. It is slower than EDS, at 60-240 bags per hour, but claims a single-digit false-positive rate.

- **Dual-energy X-ray** (Vivid/PerkinElmer, Heimann Systems): This new type of automated X-ray system processes about 1,500 bags/hour; they are being installed in London, Dusseldorf, Munich, Zurich, Sydney, Milan, Paris, and Venice. (These systems are close to being certified for use at U.S. airports.)[9]
- **MultiView Tomography** (PerkinElmer, Heimann Systems): These new versions of computerized tomography have a much higher throughput than EDS, between 1,200 and 1,800 bags/hour. One version is being installed at Amsterdam's Schiphol Airport, and the other is in field tests at various European airports..

A number of U.S. airports have proposed the use of these technologies. For example, Jacksonville proposed a system based on MVT for Level 1 screening, with EDS to resolve bags rejected by MVT. Denver has proposed a combination of Heimann 5-view tomography machines and X-ray diffraction, with an overall flow rate of over 1,000 bags/hour. Such approaches appear to be more cost-effective than EDS plus ETD.

In addition, the Blue Ribbon Committee should review all promising advanced technologies that might offer superior performance (both throughput and false-positive and false-negative rates) at reasonable cost and with more modest space and labor requirements in the coming decade. Among these might be:

- X-ray diffraction (identifying materials by chemical composition);
- Neutron-based detection;
- Quadropole resonance (QR), using low-frequency radio waves;
- Millimeter wave imaging;
- Microwave imaging.

Some of these technologies were discussed at the Aviation Security Technology Conference in Atlantic City in November 2001. The presentations at that conference suggested that the field of baggage inspection, especially explosives detection, is in ferment, with promising approaches in the developmental stage. That is all the more reason to focus more resources on serious R&D as opposed to a premature effort to deploy very costly but very imperfect technology.

R&D should also be intensified on technologies that search suspicious people, not just their luggage. Magnetometers do not detect plastic explosives or dangerous liquids that may be carried onto planes, and carry-on bag X-ray machines may not identify these items as dangerous.

B. Change the Focus from Objects to People

The approach that has been mandated in the ATSA, and is being implemented as best it can by the TSA, implicitly assumes that every bag has an equal probability of being dangerous. Therefore, it applies the same all-out complement of resources to each and every checked bag. But that premise falls apart on closer examination.

Every passenger is already screened by CAPPS—the computer-assisted passenger pre-screening system. Prior to implementation of ATSA's 100 percent checked-baggage mandate, the only bags subject to inspection for explosives are those flagged by CAPPS as belonging to a suspicious traveler. Today, those bags are put through an EDS machine if one is available, sniffed by dogs, inspected with trace detection, or opened and hand-searched.

This pre-ATSA approach is a sensible matching of resources to the likely threat. While not 100 percent foolproof, it is a smart allocation of today's limited bag-inspection resources to where they are likely to do the most good. While this existing system can certainly be improved upon, its fundamental premise is that the problem is best addressed by identifying *which passengers*—and hence which bags—need the most scrutiny.

Three key elements need to be examined in order to devise a system of matching resources to likely threat levels:

- Improving the ability to sort passengers into different risk groups;
- Applying increased technological resources to higher-risk passengers;
- Adding technology incrementally, to improve components of an overall baggage-inspection system.

These elements are discussed in the following section.

Part 5

Integrating Baggage-Inspection and People-Inspection

A. Sorting Passengers into Risk Groups

The basic principle of using inspection resources wisely requires that the most costly resources be devoted to the most serious threats, while maintaining a basic level of inspection for all passengers. Hence, passengers must be sorted into groups of differing risk levels, based on what we know about those in each group. For example, one three-part categorization would be as follows:

- **Group 3**: passengers flagged by CAPPS as potential problems.
- **Group 2**: passengers cleared by CAPPS, but about whom detailed information is not known.
- **Group 1**: passengers cleared by CAPPS about whom extensive information is known, sufficient to make them an extremely low-risk group.

To implement this approach requires two key elements. First, there must be ongoing improvement and fine-tuning of CAPPS, to ensure that its selection criteria are always current and that it is able to access all relevant federal databases that might indicate the need for serious scrutiny of a passenger. And CAPPS must be accessible at each possible check-in point: telephone, curbside, ticket counter, and boarding gate. Second, there needs to be a program under which travelers can opt to submit to a background investigation and, if cleared, be issued a tamper-proof identification card as a certified or registered traveler.

B. Matching Inspection Resources to Risk Groups

A sensible allocation of baggage-screening resources would devote extensive scrutiny to those in Group 3, using all available resources to ensure that no explosives were in their checked baggage. With today's technology, that would include EDS (if available at the airport in question) or Directed/non-Directed Trace. In addition, such individuals would also be subjected to more-intrusive passenger screening than other passengers, such as backscatter X-ray (which can see through clothing) and/or explosive-detection booths (see Figures 1 and 2). These latter passenger-inspection devices are too costly, too time-consuming, and too intrusive to be used on all passengers—but their use makes sense when confined to the relatively small numbers in the potentially high-risk group.

Figure 1: Passenger Screening, by Risk Group

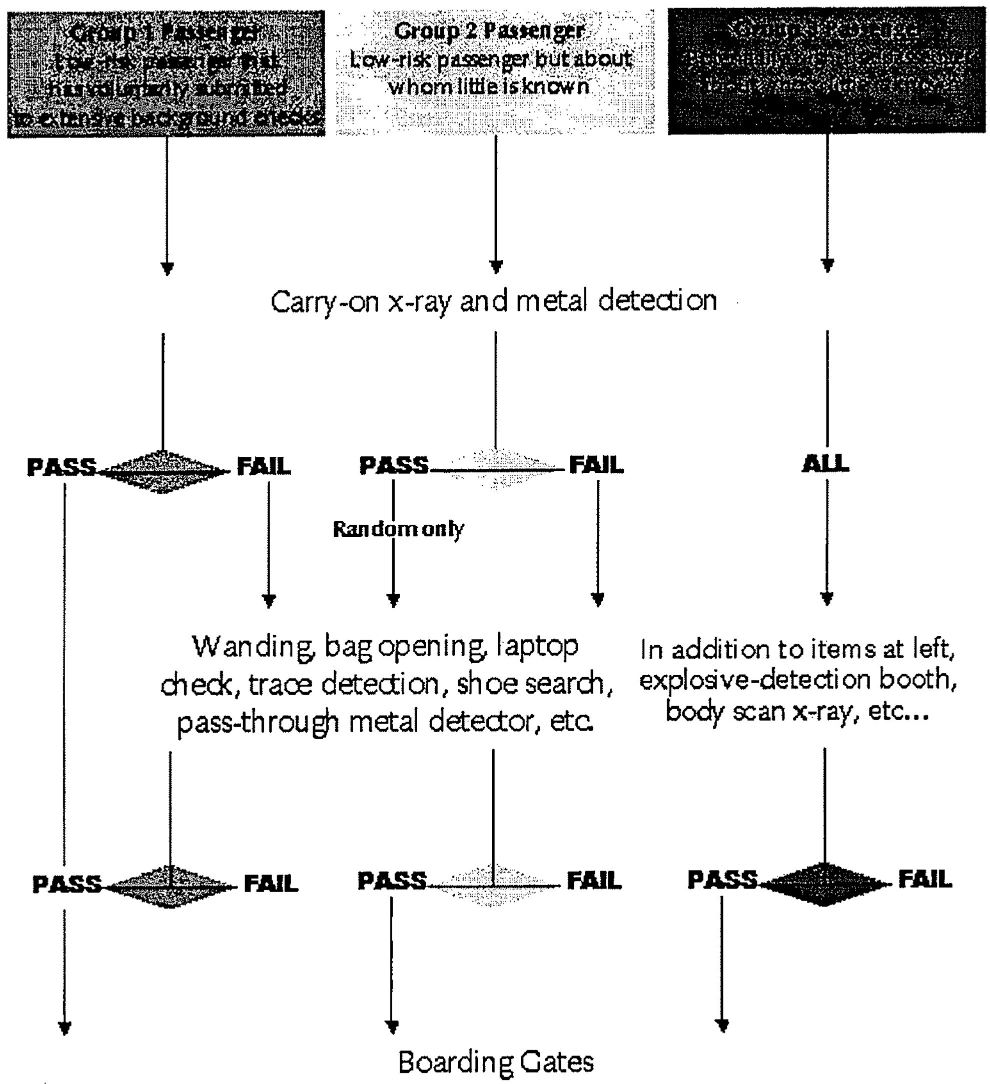
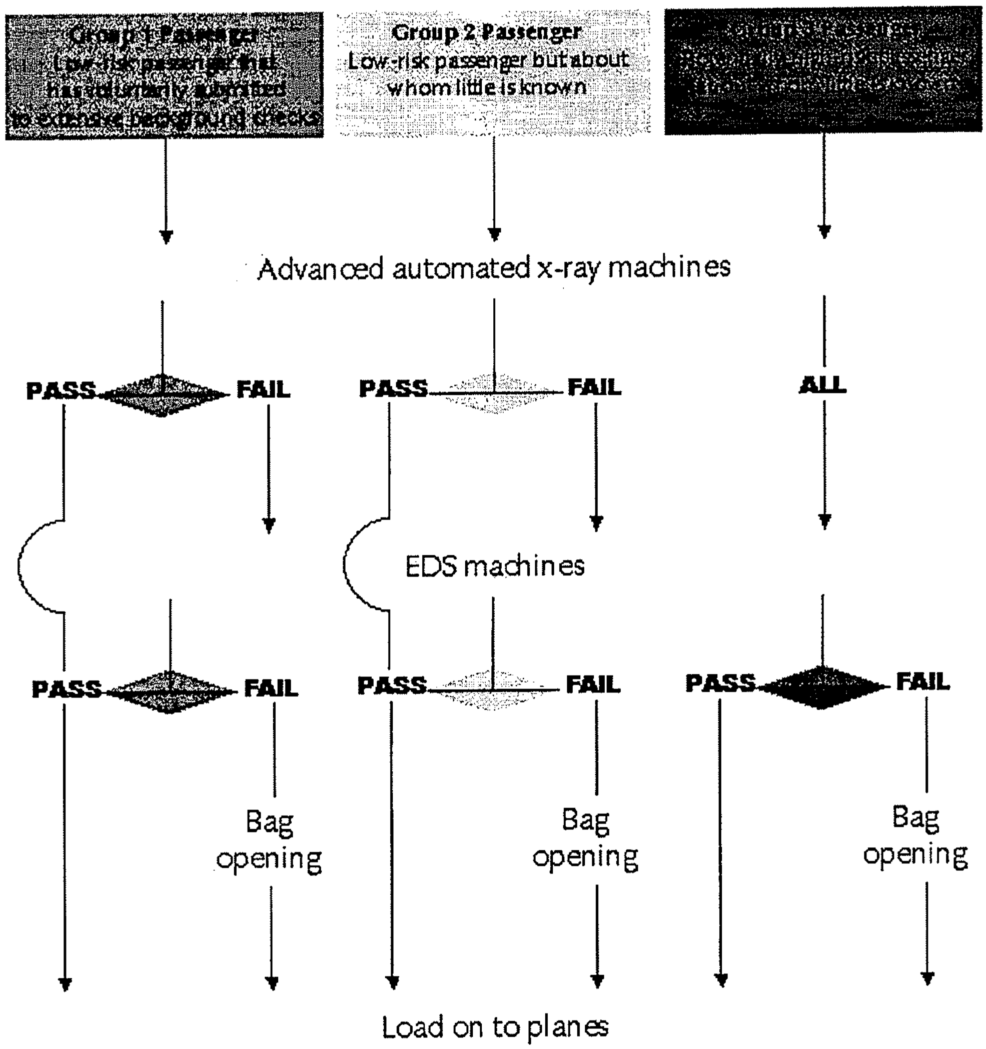


Figure 2: Tiered Checked-Baggage Screening System, by Risk Group



Those in Group 2 would have their checked luggage put through Level 1 advanced automated X-ray machines, capable of processing 1,500 bags per hour, nearly 10 times the rate of EDS. Bags flagged as suspicious by the X-ray machines could be routed to EDS or ETD for further scrutiny, with bag-opening available for those not cleared. Group 2 passengers would pass through baseline passenger screening, including metal detector and carry-on X-ray machine. They would also be subject to random Open Bag trace detection inspection of their carry-ons.

People in Group 1 would be those who have agreed to a background inspection that might include both a criminal-history check and a credit check. Upon passing those checks they would be issued a biometric card to present upon arrival at a special passenger-screening checkpoint. Once their identity as a certified traveler was verified, they would be go through an expedited baseline level of passenger screening—i.e., magnetometer and carry-on X-ray but without having to remove their laptops and without being subjected to wanding, pat-downs, trace-detection of carry-ons, or shoe inspections (unless flagged by the screening equipment). They would also be exempt from selectee status or boarding-gate inspections. Checked baggage of Group 1 travelers would be inspected in the same way as those in Group 2.

C. European and Israeli Precedents for a Risk-Based System

Europe and Israel have been coping with terrorism for several decades. Over time, their airport security systems have evolved, based on a process of trial and error learning, in order to be both as effective as possible but also to be cost-effective (to avoid using resources wastefully or in ways that burden passengers but produce negligible security benefits). Two key features of many of these airport security systems are (1) some form of certified-traveler program, and (2) a several-tier baggage system, matching resources to risk levels.

Israel pioneered the certified traveler concept, when it became clear that its rigorous passenger screening protocols were overkill for Israeli citizens who were frequent air travelers. Developed by the U.S. firm EDS, the "Express Entry" program has been in use since 1998 at Ben-Gurion International Airport in Tel Aviv. According to a recent news article, some 80,000 Israeli citizens were enrolled as of the beginning of 2002.[10] That represents about 15 percent of passenger traffic, but an EDS representative was quoted as estimating that the volume could grow to 30 to 50 percent. Prospective members apply in person, submitting to a background check and a hand scan. If approved for the program they receive an ID card encoding about 90 hand measurements. At the airport, the enrolled passenger checks in at a special kiosk, which accepts the card and measures the hand geometry, to verify that the person presenting the card is the actual enrolled person. The system has cut check-in time for card-holders from two hours to 15 minutes.

The requirement for 100 percent screening of checked baggage has been a priority in Europe for a number of years. First to act was the United Kingdom, in response to the 1988 Lockerbie bombing. The government set the goal, but provided *eight years* for it to be implemented, from 1990 through 1998. More recently, the European Civil Aviation Conference (ECAC) set a five-year deadline of Dec. 31, 2002 for more than 400 European airports in 38 countries. That voluntary goal was made mandatory by the EC's Transport Council in December 2001.[11]

European airports, including those in the UK, are generally adopting a multi-tiered approach to baggage screening. It generally avoids lobby installation of EDS machines. Instead, all explosive detection equipment is installed in-line, as part of the baggage-handling system. For example, the system developed by BAA for the three main London airports (Heathrow, Gatwick, and Stansted) uses automated X-ray machines as Level 1 screening devices. About 30 percent of bags are flagged by those devices and routed to a Level 2 X-ray machine, where an operator reviews the image on a screen. About three percent of those bags require scrutiny by Level 3 technology, an EDS (CT) machine. Bags flagged by EDS are matched with passengers and opened in a separate location. The system was developed and installed, in all seven of BAA's UK airports, for under $300 million.[12]

The all-new $2 billion Athens airport, which opened in March 2001, employs a similar three-tiered system. In this system, the Level 1 automated X-ray machines clear 80-90 percent of bags, with the remainder sent to operator-attended machines. Between 200 and 1,000 bags are flagged by these operators each day and sent to the two EDS machines in a special room with reinforced walls. If the EDS operator decides a bag needs to be opened, the passenger is summoned to that underground room and must open the bag in the presence of a police officer. Bomb squad personnel are also available, on-call.

The European model illustrates the principle of matching resources to risk levels. It also illustrates the principle of setting realistic timetables for making major changes to baggage and passenger processing, so that needed facility modifications can be made after careful planning and design. Moreover, a multi-tier system is inherently upgradable, tier by tier, as new and better technologies become available.

Part 6

Recommendations

The United States should implement policies for baggage and passenger screening that draw on best practices from European and Israeli airport security. That would mean shifting the underlying philosophy from looking for dangerous objects to identifying and dealing with dangerous people. The latter approach, relying on an improved CAPPS and implementation of a certified traveler system, would permit the development of multi-tiered checked-baggage systems. All checked bags would receive a basic level of screening, using the best available technology consistent with rapid processing rates. Bags flagged by that initial technology would be routed to a second or third level of inspection. So would bags checked in by people in the high-risk group. But the system would not have to purchase enough equipment or employ enough people to provide high-risk type inspection to low-risk bags.

Under this kind of approach, Congress should revisit the current December 31 deadline for all checked baggage to be inspected for explosives. Since the deadline cannot be met even via the TSA's interim mix of EDS and ETD (that is, without hugely costly and in part unnecessary modifications to hundreds of airport terminals and huge disruptions in passenger processing), Congress should set a more realistic deadline—perhaps December of 2004.

While Congress should avoid trying to specify particular technologies in this evolving field, it should nonetheless encourage the TSA to certify additional technologies (such as the latest generation of automated X-ray machines) that can provide a basic level of inspection for ordinary travelers more cost-effectively. Congress should also create a Blue-Ribbon Committee to both advise the TSA on certifying existing technology and to direct significant R&D funds to speeding the development of promising airport security technologies.

A more realistic deadline for 100 percent inspection and a broader choice of technologies would permit airports to design new baggage systems and develop the required facilities in a coherent, orderly manner. Given the wide array of types and sizes of passenger terminals, this approach would permit baggage systems to be tailored to the functional requirements and physical constraints of these different terminals.

In addition, since these baggage systems would not be putting all their eggs in one technological basket (e.g., EDS or ETD), they would be easier to upgrade as new and better technologies came along and won federal certification. Thus, baggage inspection systems would be subject to continual improvement as the technology progressed. This approach would provide for both (a) an immediate improvement in airport security, and (b) more resources available in three, five, or 10 years when much better technology becomes available. A multi-tiered system would not have to be replaced all at once; rather, an individual tier could be replaced, or a new tier added, depending on how much improvement a particular new technology could make.

About the Authors

Viggo Butler is chairman of United Airports Limited, Inc. and the retired CEO of Airport Group International and its predecessor, Lockheed Air Terminal. He holds a B.A. from California Polytechnic and an MBA from Pepperdine University. Early in his career, he served as a U.S. Air Force captain supervising air traffic control. He is currently a member of the FAA's Research, Engineering & Development Advisory Committee and has chaired its security subcommittee.

Robert Poole is Director of Transportation Studies at the Reason Public Policy Institute, with over 22 years of public policy research experience. A former aerospace engineer, he holds B.S. and M.S. degrees from MIT. He has authored a number of policy studies on airport and air traffic control issues and has advised the Reagan, Bush, Clinton, and Bush White Houses on various transportation issues.

Other Relevant Reason Foundation Policy Studies

Fixing Airport Security, 21st-Century Strategies for 21st-Century Threats. By Robert W. Poole, Jr. and Viggo Butler, Rapid Response #106, September 2001.

How to Commercialize Air Traffic Control. By Robert W. Poole, Jr. and Viggo Butler, Policy Study No. 278, February 2001.

Airline Deregulation: The Unfinished Revolution. By Robert W. Poole, Jr. and Viggo Butler, Policy Study No. 255, March 1999.

Passenger-Friendly Airports: Another Reason for Airport Privatization. By Asheesh Advani, Policy Study No. 254, March 1999.

Reinventing Air Traffic Control: A New Blueprint for a Better System. By Robert W. Poole, Jr. and Viggo Butler, Policy Study No. 206, May 1996.

Reason

Reason Public Policy Institute
3415 S. Sepulveda Blvd., Suite 400
Los Angeles, CA 90034
310/391-2245
310/391-4395 (fax)
www.rppi.org